HORTICULTURAL ABSTRACTS.

VOL. IV. SEPTEMBER, 1934. No. 3.

Abbreviations. Since the issue of the last number of *Horticultural Abstracts* a new edition of *World List of Scientific Periodicals* covering periodical publications issued during the years 1900-33 has appeared. As from the current number of *Horticultural Abstracts* the abbreviations used will as far as possible conform to those adopted in the *World List of Scientific Periodicals*.

Abstracts. Initialled abstracts in this number are by F. H. Beard, J. L. Edgar and M. H. Moore.

INDEX OF CONTENTS.

Horticultural Abstracts

Vol. IV September, 1934 No. 3

HORTICULTURE—MISCELLANEOUS.

314. LOEWEL, E. L. 634.1/7
Fünfjahrige Obstbauversuchsringarbeit im Altenlande. (**Five years' work of the Altenland Fruit Research Group.**)
Gartenbauwiss., 1934, **8** : 581-98.

The writer gives a general account of the activities of the research group since its origin in 1929, and tenders advice based on their own and previous trials. Trials are in progress on winter and summer spraying, manuring, storage as affected by cultural treatments, varieties and rootstocks. The main concern is apple growing but attention is also paid to other tree fruits such as cherries and plums.

315. BAGENAL, N. B. 634.1/7
Twenty-one years' work at East Malling research station.
Gdnrs'. Chron., 1934, **95** : 262, 294-6, 328-30, 348-9.

The author briefly recounts the history of the station, telling of its foundation as Wye College Fruit Experimental Station in March 1913, of its critical existence during the war years, of how in 1919 it became an independent institute under the somewhat cumbrous title of " The Kent Incorporated Society for Promoting Experiments in Horticulture " and of its subsequent rapid growth. He follows with a short popular account of the more important investigations undertaken during these first 21 years.

316. ANON. 581.143.26.03
Vernalization : a new method of shortening the vegetative period of plants.*
Gdnrs'. Chron., 1934, **95** : 117, and **95** : 183-4, bibl. 12.
and,
WHYTE, R. O., AND HUDSON, P. S. 581.143.26.03
Vernalization or Lyssenko's method for the pre-treatment of seed.
Bull. **9** *of Imp. Bur. Plant Genetics, Cambridge*, and *Occasional Publ. of Imp. Bur. Plant Genetics, Aberystwyth*, 1933, pp. 27, bibl. 21. 2s. 6d.

A very brief summary of some of Lyssenko's work and the principles on which it is based is given in the first article above. A much fuller account will be found in the second publication. Plants may be divided into three types, namely long-day plants, short-day plants and plants which do not react to differences in length of day. Considerable difficulty is thus often experienced in

* See also short article in *Fruitgrower*, 1934, 77 : 1989 : 137 and Masters Memorial Lectures, 1933, *H.A.*, 1934, 4 : 3 : 317.

inducing long-day plants to develop satisfactorily to the reproductive stage under short-day conditions and vice versa. Under artificial conditions in a greenhouse by varying the conditions of light, darkness, temperature humidity etc., it is possible to retard or accelerate reproduction. This is not ordinarily possible under field conditions. The methods by which Lyssenko hopes to overcome this difficulty are here described and an account of his technique is given both for vernalizing long-day and short-day plants. Treatment is given to just germinated seed in both cases. Lyssenko works on the principle that the process of preparation of a plant towards reproduction may occur in the embryo and may be separated in time from the growth of the plant and that therefore the practical application of the method of vernalization becomes possible. " Vernalization is the influence of the complex of factors corresponding to the plant in question which make possible the occurrence in the seed material of those processes which determine the transition of the plant to the reproductive stage." These influences he brings to bear prior to sowing. Successful experiments have been made with wheat, a long-day plant, and with such short-day plants as soya bean, sorghum etc. In all the above cases the interest has lain in the reproductive processes, but work has also been done on potato tubers to induce early vegetative development and production of tubers. Incidentally the essence of vernalization of potatoes is the application of continuous illumination for a few weeks prior to planting. The possibilities as an aid to breeding work in horticulture seem to be immense.

317. BLACKMAN, V. H. 581.143.26.03 : 612.014.44 : 551.52

Plants in relation to light and temperature. Part II. Effects of temperature.

(Masters Memorial Lectures 1933, Part II.)

J. roy. hort. Soc., 1934, **59** : 292-9.

Temperature ranks below water-supply, but is more important than light in controlling the distribution of plants on the earth's surface. In considering optimum temperatures for plants it must be remembered that these vary greatly with the stage of growth reached by the plant. They also vary with the length of time during which the plant is exposed to the particular temperature. Tests with garden cress roots show that the optimum temperature for a period of $3\frac{1}{2}$ hours is 30° C. (86° F.) but for 14 hours 27·2° C. (81° F.). Again the effect of temperature varies with different light intensity. Thus with young tomato plants in greenhouses, as the light intensity increases, so the most suitable temperature also rises. Russian scientists, mainly at the Odessa plant breeding station, have shown that physiological predetermination can be achieved by light as well as by temperature and that it can be of practical value to agriculture and horticulture. In this process of " vernalization " exposure to low temperature given to the swollen but still actually ungerminated wheat or rye grain markedly accelerates subsequent ear formation and so secures an earlier harvest. The same workers have also investigated the effect of light. Such tropical or sub-tropical plants as sudan grass, soya bean etc. for normal reproduction need a high temperature and a short daily period of illumination. Hence arises the difficulty of growing them for seed in northern latitudes. It has, however, been found that by treatment of the seed the plant may be brought into such a physiological condition that the reproductive phase occurs later irrespective of exposure to short days, in fact even in continuous light. This is produced by exposure of the swollen seed to a period of darkness at a fairly high temperature. In millet the reproductive phase is ensured by keeping the partly moistened seed in the dark for five days at 25-30° C. (77°-86° F.). The phenomenon of the almost simultaneous flowering of certain tropical plants due to a sudden burst into activity due to some change in environment acting as a " trigger mechanism " is discussed. Thus coffee flowers within a week of rain following a period of drought. In this case again it is the effect of a change in environment, and wetting or cooling or increased soil moisture would all equally well serve to rouse the buds from their dormant but changed condition. In the bulb industry a study of the effect of temperature on the formation and later of the unfolding of the bud enables the production of very early forced flowers. By proper temperature treatment tulips and hyacinths can be made to complete their life cycle in 8 to 9 months. Finally the importance of interaction of factors must be realized. Light, temperature, air humidity and soil humidity are all important and the alteration of any one of them will almost certainly affect the action of the others.

TREE FRUITS, DECIDUOUS.

*Breeding.**

318. LENIN ACADEMY AGR. SCIENCES. 634.1/8-1.52
Principles of the organization and methods of plant breeding. II. Fruits and small fruits. [In Russian.]
Lenin Acad. Agr. Sci., Inst. Plant Industry, Suppl. **64**, to *Bull. Applied Bot., Genetics and Plant Breeding*, 1934, pp. 80.
The problems which arise in plant breeding are briefly discussed in their relation to the principal orchard and bush fruits, reference is made to work done in England, America and Germany, and a programme suitable for the U.S.S.R. is drawn up.

319. TUKEY, H. B. 631.523 : 634.23 +634.25
Anomalous embryos of cultivated varieties of *Prunus* with particular reference to fruit breeding.
Bot. Gaz., 1934, **95** : 493-7, bibl. 2.
Observations are recorded of anomalous peach and cherry embryos made during the removal of embryos from 27 peach and 17 sweet cherry varieties for study of development and artificial culturing of embryos. The occurrence of embryos with more than 2 cotyledons was found in 5 varieties of cherry and 4 of peach, 3 cotyledons being found in every case except one when there were 4. It was possible to germinate these embryos. The suppression of one of the two normal cotyledons was frequent, especially in the cherry. It was not uncommon to find the cotyledons abnormally shaped showing the tip of one cotyledon folded over that of the other or other abnormal features. Anomalous embryos were found to occur more often in some varieties than in others and more often in horticultural varieties than among the wild species types. The heterozygous condition of cultivated varieties of peach can thus be compared with the more homozygous condition found among the wild species.

320. SAX, K. 634.1
The origin of the *Pomoideae*.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 147-50, bibl. 11.
The results of investigations in this field cause the author to consider it quite probable that the *Pomoideae* are of allopolyploid origin, and were produced by hybridization between different primitive forms in the *Rosaceae*, followed by chromosome doubling. It seems probable that they were derived from a single ancestral type and that mutations and minor changes in chromosome morphology have been responsible for generic and species differentiation.

321. KHOMENTOVSKY, G. I. 634.11 : 581.42 : 575.1
†Contributions to the germinating ability of seeds as resulting from hybridization work on apple trees in 1925-1929. [Russian-English summary.]
Sci. Res. Inst. S. Hort. Tree-and-Small Fruit, Issue **16a**, 1932, pp. 67, bibl. 17.
In producing apple seedlings for use as rootstocks, it is now recognized as essential that the seedlings be as uniform as possible ; this can only be achieved by controlling the parentage of the seedlings. Some parental combinations moreover are found to give more valuable seedlings than others. Germinating capacity is an important quality both in this connection and in breeding work of all sorts. In 1924 extensive work was begun at Mleev on crossing between cultivated and wild varieties of apples. After counting the number of seeds obtained from each combination they were sown and counts made of the number that germinated. In this way as many as 60,000 seeds were examined in the course of five years, representing 276 combinations of the 16 maternal and 59 pollen parents. The results are presented in such a way that the influence of a particular

* See also 372.
† Abstract received from the Imperial Bureau of Plant Genetics, Cambridge.

variety on the germination of the seeds when employed both as pollen and as seed parent can be assessed. By aggregating the results of each individual year the difference between one year and another was estimated. For the entire material over the whole period of investigation the average percentage germinated was 60·8 per cent. Certain of the maternal varieties were always above the average, and some were always below, while others varied from one year to another; the pollinating varieties could be arranged in similar groups. Moreover, the position of the varieties in the groups was with very few exceptions the same when considered as pollinators and when considered as seed parents. A similar grouping can be made for the different combinations of parents, the behaviour of a given combination corresponding largely to that of the constituent varieties considered individually. The results of reciprocal crossings in the 16 cases where they were made were also mainly identical or very similar. A study of the individual years showed that certain combinations of parents every year gave seeds no lower in germinating power than the higher of the two parents, others were in every year no higher than the lower of the two parents taken as the average over the whole period, and here again the behaviour of the different combinations corresponds very closely to that of their constituent varieties. Finally, certain combinations attracted attention by giving repeatedly germinating percentages very much in excess of the 6 averages for the year, and others much lower. The highest germination observed was 95 per cent., the lowest 2·4 per cent. There would seem to be no doubt from these facts that germination capacity is a hereditary character, though its genetical constitution is not yet entirely clear. Some of the varieties were also subjected to self-pollination, the seeds from which, 750 in number, gave a germination of 66·8 per cent., being in no case less than the corresponding germinating percentage of the cross pollinated seeds. There was no correlation between the germination capacities of the seeds and the pollen fertility of a particular variety or the degree of success obtained in crossing a particular combination of varieties.

*Propagation.**

322. ROACH, W. A. 631.541
Budding and grafting razors.
Gdnrs'. Chron., 1934, **95** : 196-7, bibl. 5.

The author describes and illustrates a simple form of scalpel the cutting part of which consists of a safety razor blade, which he has adapted for use in grafting work with strawberry plants and similar material. Instruments for patch budding consisting of two blades clamped between plates are also shown and described.

323. MILDNER, H. B. 634.11-1.541
Versuche über die Anzucht von Apfelokulanten unter verschiedenen Kulturmethoden. (**Raising apples by budding with and without the use of stubs.**)
Gartenbauwiss., 1934, **8** : 634-44.

A further article (see *H.A.*, 1931, 1 : 1 : 34 and 1934, 4 : 2 : 166) on dispensing with the stub and cutting the stock off close to the bud when budding apples. These experiments at the Mitchurin research institute confirm previous work and show that the stub can be profitably eliminated.

324. VEKHOV, N. K., AND ILJIN, M. P. 631.535
Vegetative propagation of trees and shrubs by means of summer cuttings. [Russian-English summary.]
Lenin Acad. Agr. Sci. in U.S.S.R., Inst. Plant Industry, Supplement **61** to *Bull. Applied Bot., Genetics and Plant Breeding*, 1934, pp. 284.

The experiments described in this bulletin were undertaken in central Russia to discover the suitability of a large number of trees and shrubs for mass propagation by means of leafy shoots in summer. The questions investigated for each variety were rapidity of callus formation and of rooting, percentage of cuttings rooting, degree of root and of shoot development, the best age

* See also 447, 449, 453, 454, 455.

and time at which to take the cuttings, position on parent trees and maturity of the shoot to be propagated, degree of bottom heat required. Results on the above lines are given in tabulated form for 600 varieties from 479 species and 118 genera, a total of 118,000 cuttings. With the majority of the plants beds of sandy soil with a surface layer of pure sand and no bottom heat, planted with cuttings in June and July, were very successful. Only 8·5 per cent. of the species failed to root and it is thought that further experiments would reduce this percentage considerably.

Rootstocks.

325. HATTON, R. G., AND BAGENAL, N. B. 634.1/2-1.541.11
Scion rooting at East Malling research station.
East Malling Res. Sta. Ann. Rept. for 1933, **A.17**, 1934, pp. 243-5, bibl. 4 (reprinted from *Kent Farmer's Journal*, June 1933).
Numerous definite cases are cited of apples and pears showing the striking effects of scion rooting, certain varieties and stocks being particularly prone. It is suggested that low working on the stock stem and planting with the union below ground should be abandoned. [From authors' summary.] Of 120 plum trees lifted and examined only 2, both on Brussel rootstock, were found to have scion rooted.

326. DAY, L. H. 634.22-1.541.11
Ripening dates of Grand Duke plums on various understocks.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 357-60.
Some 12 acres at Davis have been planted with the leading varieties of plums, peaches, apricots and almonds on 10 different rootstocks. The age of the trees varies from 5 to 10 years. In addition a number of mature trees have been topworked with common varieties for the study of graft affinities and reciprocal influences. Notes are given of measurements made of the growth, date of ripening, size of crop and general condition of some 21 Grand Duke plum trees worked on particular stocks or topworked on common varieties.

327. TUKEY, H. B., AND BRASE, K. D. 634.13-1.541.11
Trials with pear stocks in New York. (Preliminary report.)
Proc. Amer. Soc. hort. Sci., 1933, **30** : 361-4, bibl. 5.
Varieties used are Bartlett, Seckel, Beurré d'Anjou, and Kieffer on eight seedling stocks, namely *Pyrus betulaefolia, P. Calleryana, P. serotina, P. ussuriensis, P. communis* (imported French pear), *P. communis* (domestic French pear seedlings), *P. communis* var. Bartlett, and *P. communis* var. Winter Nelis. Comparative sizes after three seasons' growth are shown diagrammatically and the following notes are made as to other effects :—All the *P. communis* rootstocks have been uniformly successful, the tress showing vigour, no mortality among the 84 planted, and general uniformity. *P. betulaefolia* has been excellent for all except Beurré d'Anjou. *P. Calleryana* has been uniformly unsuccessful. *P. ussuriensis* has been really successful only for its near relative, the Kieffer. The same applies to *P. serotina* also.

*Root growth.**

328. ROGERS, W. S. 634.1/2 : 581.144.2
Researches on fruit tree root systems.
Sci. J. R. Coll. Sci., 1934, **4** : 120-9, bibl. 13.
After touching briefly on rootstock classification work at East Malling the author discusses the effect of soil on the rootstock as shown by excavations made by himself and other workers. The most striking feature in sandy soil is the spread of the roots, which spread twice to three times

* See also 428, 450.

as far as the branches. In an East Malling loam consisting of some 9 inches dark medium loam with lighter loam subsoil extending to the ragstone rock some 4 to 6 ft. below ground level, the main scaffolding of roots sloped gently down and up in the top 2 feet of the soil, and from these roots vertical roots descended to the rock. In a stiff, dark clay top soil passing into a stiff, sticky clay subsoil at about 1 foot the roots sloped down from the trunk and mainly occupied the subsoil between 1 foot and 2 feet. A depth boundary of 2·6 to 3 ft. was very sharply marked in the root system, older roots being killed back to about 3 ft. by prolonged immersion in water. The absorbing system of fine root hairs was found to be fairly evenly distributed over an area even wider than that of the spread of the branches. The number of deep roots possibly explains why the effect of fertilizers is often not apparent for some years. Slight notes are given on the technique of excavation and the author describes a method by which direct observations are being made on growing apple roots in the field, It is now possible to record the period, rate and position of new root growth and to note the suberization of the root and its subsequent behaviour by the use of observation trenches containing glass windows supported against the soil. It would appear that root growth would vary with the temperature, provided there is sufficient moisture. Lack of moisture quickly checks growth.

329. Rogers, W. S., and Vyvyan, M. C. 634.11 : 581.144.2
Root studies. V. Rootstock and soil effect on apple root systems.
J. Pomol., 1934, **12** : 110-44, bibl. 11.

The data presented here with adequate root plans, tables and illustrations are taken from the excavations made on loam, sand and clay soils of twenty-six 10- and 11-year-old Lane's Prince Albert apple trees growing on known rootstocks showing a complete range of vigour from very dwarf No. IX to very vigorous No. XVI. In all cases the root spread was greater than that of the branches, in sand being two to three times as great. A large proportion of the fine fibrous roots were found well away from the trunk, and in the case of the loam nearly half the fibre was outside the 3 metre square surrounding the trunk. This shows the necessity for manuring even well beyond the spread of the branches. Root depth varied, the greatest depth of 296 cm. or over 9 ft. 6 in. being attained by a No. IX stock in the loam soil. The great depth of many of the roots explains why manures applied to the surface may take several years to show any effect. The roots on the sand were shallower than on the loam, the same general conformation of a shallow scaffolding with vertically descending roots being found. Here the maximum depths reached were No. IX 80 cm., No. II 137 cm., No. I 115 cm., and No. O.F.5 190 cm. In most cases more than three quarters of the total root weight was less than 30 cm. deep. In the clay the main scaffolding was deeper. There was a sharply marked boundary at about 90 cm. probably due to a seasonal water table preventing aeration. The type of root was modified by the soil. In the sand roots were long, thin, straight and spreading. In the clay they were fairly short, tapering, rapidly branching and twisting. In the loam they showed intermediate characters. Despite however, the effects of soil, the roots of the different stocks were recognizable by their distinctive characteristics. In an appendix is given an interesting account of the technique of excavation, grading and weighing and of the methods used to ensure a fair measure of accuracy throughout. The authors stress the necessity for much fuller information on the effect of soil moisture on root growth and note that such information is being gained in the special root observation boxes at East Malling.

330. Kemmer, E. 634.1/7 : 581.43
Die Gestaltung der Wurzelkrone bei Obstgehölzen. (**The conformation of the root system in fruit trees.**)
Institut für Obstbau der Landwirtschaftlichen Hochschule, Berlin, Merkblatt **2**, 1934, pp. 8.

The author gives 36 clear photographs of root systems of various fruit trees, taken some with the trees still in situ, others of the roots removed and washed out. Brief notes are given on the observations made and conclusions are drawn applicable to planting practice. Figures are not given

of the amount of material available for observation. The conclusions reached are as follows: 1. The early stage of root development in so-called "deep rooters" even under favourable soil conditions is not a guide to the appearance which the root will present later. 2. The tendency to further the development of shallow roots, which in early stages are very weak, at the expense of deeper roots is common to all fruit trees. Deep-lying roots have a tendency to rise towards the surface at some distance from the trunk. 3. Root spread is on the average about 3 times that of the branches. 4. Under conditions of proper cultivation the strongest roots close to the trunk form an important fibrous system.

Growth, Nutrition.

331. Magness, J. R., and Others. 634.11 : 581.145
Time during which fruit bud formation in apples may be influenced in the Shenandoah-Cumberland fruit districts.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 313-8, bibl. 2.

Branches were selected carrying approximately equal amounts of fruit in relation to foliage. As soon as fruit set was determined they were adjusted by fruit removal to leave 100 good leaves per fruit, and rings of bark were removed to prevent the translocation of synthesized food material from these limbs. Series of branches were treated at successive fortnightly intervals from late May to September. Similar branches were left untouched. In the following spring records were made of the total number of growing points and the percentage of these which formed fruit buds. So long as fruit bud formation on the ringed branches averaged appreciably above that on the check branches the treatment was held to be responsible for the difference. Varieties were found to differ in the length of time in which their fruit bud formation could be influenced. As a result the authors consider that in order to be effective in determining fruit bud formation in the district in question treatments must apparently be applied sufficiently early to modify conditions within the buds within 50 to 60 days after full bloom.

332. Fisher, D. V. 634.11 : 581.45 : 581.14
Leaf area in relation to fruit size and tree growth.
Sci. Agric., 1934, **14** : 512-8, bibl. 4.

The apple trees in the trial are seventeen-year-old McIntosh, Delicious, Rome Beauty and Newtown. Thinning treatments ("heavy" = where apples are spaced 9 inches apart, "medium" 6 inches apart, "light" 3 inches apart) have been applied annually to the same individual trees, so that the cumulative effects of 13 years thinning can now be seen. The areas of the leaves were measured by the "integrator", a device described both here and in *J. Pomol.*, 1932, 10 : 228-70. It was found that the size of fruit is positively correlated with leaf area per apple. The weight of fruit produced per 100 square centimetres leaf area was determined and was found to vary between the different varieties. It is suggested that this may be accounted for by differences in photosynthetic efficiency of the leaves. Growth was greater in heavily thinned than in lightly thinned trees, possibly because in the former case more synthesized materials were available for translocation back into the tree.

333. Auchter, E. C., and Roberts, J. W. 634.11 : 581.145.1/2
Experiments in spraying apples for the prevention of fruit set.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 22-5.

The sprays used, none of which were completely satisfactory, were calcium polysulphide (liquid lime-sulphur) 1 to 8-10 gallons, sodium polysulphide 1 lb. to 5 gallons, copper sulphate 4 lb. to 50 gallons, sodium nitrate 8 lb. to 50 gallons, zinc sulphate 8 lb. to 50 gallons, oil emulsion (Govt. formula viscosity 250) 2¼ to 50 gallons. Those that entirely prevented fruit set injured the leaves severely. Some of the trees were sprayed in the late cluster bud stage, some at or near full bloom, and some at both these times.

334. SCHULTZ, H. 634.1/7 : 551.56
Feststellung der Erntegüte im deutschen Obstbau seit 1880 unter Berücksichtigung der jeweiligen Witterungsverhältnisse. (**A consideration of fruit crops obtained in Germany since 1880 and of the effect thereon of weather conditions.**)
Landw. Jb., 1934, **79** : 171-96, bibl. 14.

The author has had to rely on figures or notes taken from unofficial sources such as journals, e.g. the *Praktischer Ratgeber*, *Pomologische Monatsheft* etc., for districts in Germany other than Würtemberg and Hessen. Data are tabulated and show in each year whether there was a good, medium or poor crop, weather experienced during winter, spring, time of flowering, and summer, and finally any additional factors that may have affected crop, e.g. attacks of *Anthonomus*, exceptionally early fall of leaves etc. The figures of 52 years show that the weather during blossoming has been the most important climatic factor influencing crop. At the same time the weather in the previous summer and during the growth of the fruits, though not of equal importance, is nevertheless important.

Pollination.

335. HOOPER, C. H. 634.11 : 581.162.3
Apples, the relative order of flowering of the different varieties and its bearing on cross fertilization.
J.S.E. agric. Coll. Wye, 1934, **34** : 210-5, bibl. 13.

The author concerns himself only with investigations in England. He notes that records of order of flowering have at different times been taken at the following places :—Droitwich, Hereford, Long Ashton, Woburn, Chelmsford, Wisley, East Malling, Maidstone, Wye. The average period during which flowering of any one variety was in progress varied in the different places from about 13 to 17 days. A tabulation is made of varieties of apple commonly grown for market in their approximate relative order of flowering.

336. TUFTS, W. P., AND HANSEN, C. J. 634.13 : 575.18
Xenia and metaxenia in the Bartlett pear.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 134-9, bibl. 7.

Some five or six other varieties were used as pollen parents. They undoubtedly influenced the shape of the fruit, but this variation in shape may have been due to the ability of the particular pollen to produce seed rather than to metaxenia. It is concluded that, if metaxenia does occur in the crosses studied, i.e. with Beurré Hardy, Easter Beurré, Comice, Winter Nelis, Anjou, P. Barry and Beurré Bosc, its effects are not great and are masked by the effect of the number of seeds. No effect on colour was observed.

337. TOSTI-CROCE, E. 634.22 : 581.162.3
Sull'autosterilità del susino "Burbank". (**Self-sterility in the Burbank plum.**)
Ital. agric., 1934, **71** : 575-80, bibl. 10.

The author discusses results of other workers and describes his own recent pollination experiments. It is found that the Burbank can be cross-fertilized by other species of the genus *Prunus*, *P. cerasifera*, *P. Pissardi* and *P. spinosa* being particularly effective pollenizers. His observations and deductions suggest to the author that the Burbank plum originated as the result of perissoploidy or at least factorial anomaly and that it has a close affinity with European *Prunus* species in general.

338. PEARSON, O. H. 581.162.3 : 631.523
Influence of materials and colours upon plant temperatures within bags.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 501-6, bibl.1.

The temperature within the bags used for pollination experiments has a considerable influence on seed formation. As regards different bag materials the superiority of muslin for lowering the temperature of leaf tissue contained in the experimental bag was very marked in these experiments. Manila and bond paper were nearly as good, their maximum temperatures approximating that of the exposed leaves in the trial. Glassine and cellophane were much warmer. Coloured

cellophane was slightly cooler than colourless, though bond paper washed with an aqueous solution of Safranin O, Orange G or Gentian Violet were hotter than untreated paper. Temperatures of leaves in the muslin bags washed with the same stains as were used for the paper were slightly lower than in the white muslin bags. His data lead the author to consider that a small bag made of dark, highly porous material such as muslin would keep the temperature of enclosed leaves down to approximately that of fully exposed leaves, whereas a transparent material such as glassine or cellophane would appreciably raise it.

339. SCHANDERL, H. 634.13 : 581.162.3
Die Befruchtungsverhältnisse bei unseren Obstsorten. I. Birnen. (Sammelreferat.) (**Fruit pollination in Germany. A summary of the position as regards pears.**)
Züchter, 1934, **6** : 6-12, bibl. 29.

This article affords a concise, clear guide to the literature and work on the subject. A table of good and bad pollen varieties is given based on the work of Italian, German, Swedish and Swiss investigators, a variety being considered good when its pollen germination capacity has been found by at least two authorities to be above 33%. The author summarizes the conclusions which should be drawn by scientific workers as follows :—(1) Since up till the present all pear varieties have proved to be self-sterile in the narrow sense of the word, castration can be omitted in cross-pollination experiments. This makes it possible to work with large numbers of flowers. Generally speaking at least 100 flowers should be used for any one pollination experiment. (2) Pollen germination tests must be made as well as self- and cross-pollination tests. It is essential to understand the characteristics of the pollen used in any cross-pollination trial, in order to know in the case of repeated failure of a particular cross-pollination, whether one is faced by real inter-sterility or merely degeneration of pollen in the pollen variety used. (3) The study of seed development is most important both in self- and cross-pollination studies. (4) Since pear varieties capable of producing normal fruits in the absence of pollination would be of the greatest value to fruitgrowers, the shape, size, flavour and time of ripening of all parthenocarpic fruits should always be noted.

340. RUDLOFF, C. F. 634.22 : 581.162.3
Die Befruchtungsverhältnissen bei unseren Obstsorten. II. Pflaumen. (Sammelreferat.) (**Fruit pollination in Germany. A summary of the position as regards plums.**)
Züchter, 1934, **6** : 121-9, bibl. 34.

The author gives a full survey of modern work on the subject. The results of self- and cross-fertility tests of some 38 varieties are tabulated according to the observations of named workers in U.S.A., England, Sweden, Denmark, Russia and Germany. That every shade of fertility can be found, in the *domestica* group at least, from complete self-sterility, via cross-infertility and cross-fertility to self-fertility makes an explanation of these phenomena extremely difficult. It is, however, thought that in polyploidy may well be found the explanation of varying fruitfulness, of genetically caused pollen sterility and of the different degrees of susceptibility shown by the reproductive organs and their products. Practical suggestions are made with regard to varieties found self-fertile or self-sterile in Germany and notes are given on possible pollen varieties, though it is stated that much more work is necessary on this point.

341. VON VEH, R. 634.11 : 581.162.3
Zur Frage nach dem wissenschaftlichen Nachweis einer cytologisch bedingten Ei- und Zygotensterilität bei triploiden Apfelsorten. (**On the question of scientific proof of egg- and zygote- sterility arising from cytological causes in triploid apple varieties.**)
Züchter, 1934, **6** : 86-8, bibl. 6.

This is merely a reply to a criticism of the author's previous work* by Steinegger in his article "Cytologisch bedingte Ei-und Cygotensterilität bei triploiden Apfelsorten" (*Ber. Schweiz. bot. Ges.*,

* *Züchter*, 1933, Band 5, Heft 4. Ergebnisse einer entwicklungs-geschichtlich-cytologischen Untersuchung der Samenanlagen der Apfelsorte Schnöner v. Boskoop.

vol. 41, and published separately by Büchter of Bern). Steinegger deplores the fact that von Veh restricted his investigations to Belle de Boskoop, which is a triploid, thereby depriving himself of results which were at all comparable with those obtainable with a diploid, and suggests that he thereby made it impossible for himself to interpret correctly the abnormalities observed. von Veh replies that he neither looked for nor interpreted abnormalities, but merely commented on them. The rest of the article is a tilt against certain of the conclusions reached by Steinegger, and the suggestions of probable error in certain named particulars. The points are dealt with more fully in his article in *Gartenbauwissenschaft*, 1933, Band 8, Heft. 2.

Manuring, cultural practice.

342. Verner, L. 634.11-1.84 : 664.85.11
Effects of nitrate fertilization on apple fruits.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 32-6, bibl. 6.
This is an account of experiments in West Virginia made to test the effect of nitrogen fertilizers on storage quality of apples. Broadly speaking, they confirm the results of other workers in the States such as Gourley and Hopkins and Aldrich. The author considers that results noted so far are more probably due to increased leaf area rather than to the direct effects of more nitrogen in the fruit. The shaded fruits of nitrated trees do not differ much from similarly shaded fruits of unshaded trees, but they do constitute a greater proportion of the total crop. Hence nitrate fertilizers are of great importance in their influence on fruit colour and dessert quality. But, as regards firmness after storing, nitrogen content, respiration and transpiration rates and—if allowance is made for proper maturity—susceptibility to scald, they are of little or no importance.

343. Beaumont, J. H., and Chandler, R. F. 634.1/2-1.83
A statistical study of the effect of potassium fertilizers upon the firmness and keeping quality of fruits.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 37-44, bibl. 3.
In a previous progress report* Weinberger notes no effect on firmness and keeping qualities due to potassium fertilizers, but further results extending over a 6-year period show that lack of potassium tends to make apples and peaches firmer at picking time but more quick to soften in storage. The method of picking a random sample and then determining the various factors affecting the firmness of the fruit by " analysis of variance " is presented as an effective means of attacking such a problem. The weighted average is discussed as a means of more fully evaluating the effect of fertilizers on firmness and keeping quality. In general weighted averages are found to be highly correlated with simple averages.

344. Chandler, R. F. 634.1/2-1.83
The replaceable potassium content of orchard soils in Maryland as affected by potassium-carrying fertilizers.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 62-6, bibl. 5.
In this paper only data from apple orchard soils, on which fertilizer experiments are in progress, are discussed. Soil samples were taken from 3 successive 6 inch layers under 3 fertilizer treatments, namely no potassium, 5 lb. KCl per tree per year and 10 lb. KCl. They were obtained in the summer after 4 annual applications had already been made. Four widely differing soils ranging from a clay loam to a loamy sand were thus investigated. They were found to vary greatly in their replaceable K content. The replaceable K decreases generally with increase in depth especially in the first 12 inches. Applications of K resulted in a considerable fixation

* See *Ibidem*, 1929, 26 : 174, *H.A.*, 1931, 1 : 1 : 51.

of K in the upper layers of all the soils except those of the loamy sand, where it was not so marked. It is considered that this fraction of the soil K is a function of the colloid content of most soils.

345. Proebsting, E. L. 634.2-1.84/85
Orchard trials of nitrogen and phosphorus.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 426-30, bibl.4.
In experiments with apricots, peaches and prunes an attempt was made to get over the difficulty caused by the normal high fixing power of soils for phosphorus—which therefore does not become available to the plant—by applying the fertilizer in furrows deep enough to cut many of the small roots. This did not result in a measurable increase in P absorbed, nor did it influence tree growth and yield.

346. Potter, G. F. 634.11-1.84
Spring and mid-summer applications of nitrogen in the apple orchard.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 164-8.
Lyon, Heinicke and Wilson had shown that in sod orchards heavy applications of available nitrogen made in early spring disappear by mid season. Hence it was decided to try the effect of dividing the annual applications into two doses. Observations were made for some 5 years on McIntosh, Baldwin and Rhode Island trees treated in this way and the yield, size of fruit, colour, spur formation, set of fruit, twig growth and trunk girth were compared with those of trees to which all the nitrogen was applied at one time. Although in most cases there was a slight gain when the application was divided, the differences were in no case significant.

347. Proebsting, E. L. 634.13-1.8
A fertilizer trial with Bartlett pears.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 55-7, bibl. 4.
The soil at Lakeport, California, the scene of this trial, is gravelly clay, the trees over 25 years old. Irrigation is not practised. Annual rainfall is 36 inches. N, K and P were given alone and in different combinations. The yields of fruit were higher on the plots receiving nitrogen than on other plots. In view of results the author considers that only nitrogen can at present be given a place in the fertilizer programme for pears in these soils.

348. Thomas, W. 634.11-1.84
The distribution and condition of nitrogen in three horizons of a differentially fertilized Hagerstown clay loam soil planted to apple trees in metal cylinders.
J. agric. Res., 1934, **48** : 845-55, bibl. 17.
In a previous article (*Ibidem*, 1933, 47 : 565, *H.A.*, 1934, 4 : 1 : 37) the author discussed the absorption of nitrogen, phosphorus and potassium by apple trees grown in cylinders and subjected to differential treatment with nutrient salts. In this paper he reports on the status of the nitrogen in the 3 soil horizons in the cylinders from which the trees referred to above were removed. The horizons were 0 to 7 inches, 7 to 21 inches and 21 to 53 inches of a clay loam soil. In all treatments the total nitrogen of the surface soil under sod was somewhat greater than under cultivation. In the sub-surface soil the differences in total nitrogen were small except in the check cylinders under sod, where it was less than under tillage. In all treatments the total nitrogen of the subsoil was greater in the cylinders under cultivation than in the corresponding cylinders under sod. Altogether, i.e. in the whole 53 inches, the final total nitrogen was greater in all cylinders under cultivation than in those under sod. The disappearance of nitrogen by leaching and possibly as gaseous nitrogen was always greater under sod. The leaching of nitrates was not very rapid from this heavy soil. After taking account of the nitric nitrogen absorbed by the trees, the disappearances of it was greater in all nitrated cylinders under cultivation than in cylinders under sod. In the subsoil under cultivation there was an accretion of nitrogen in non-nitric form, which would account for this. [From author's summary.]

349. Thomas, L. A., and Roach, W. A. 634.1/7-1.811
Injection of fruit trees : preliminary experiments with artificial manures.
J. Pomol., 1934, **12** : 151-66, bibl. 15.

The injection of nutrient salts into fruit trees has not yet been adopted as a common method of diagnosing deficiency ills or of curing them, possibly owing to the fact that serious damage may result from ill-advised methods of injection. The authors show from their own experiments with trees on known rootstocks that damage will vary according to variety, rootstock, compound of element injected, concentration of injected solution, total amount injected. It was found that 0·25 per cent. solutions of all the 21 chemical compounds used could be injected without injury. Enough, moreover, was absorbed in 24 hours to bring about growth increases as great as any produced by very heavy applications to the soil. The authors conclude that all nutrient elements may be injected without ill effects, if suitable compounds are used and these are dissolved in sufficient water. Two growth increases resulting from their experimental injections are discussed. The technique adopted is described but it is noted that a fuller account of improved methods is given in the second author's article on the subject, which occurs in the *East Malling Research Station Annual Report for 1933*, publ. 1934, pp. 137-41 (noted in *H.A.*, 1934, 4 : 2 : 192).

350. Maume, L., and others. 581.192 : 543/545
Dosage rapide et précis de N, P, K, Mg, Ca, par semi-microanalyse. (**Determination of N, P, K, Mg and Ca by semi-microanalysis.**)
Ann. Ec. Agric. Montpellier, 1934, **23** : 5-43, bibl. 27.

The authors consider that their technique should be of great value in agricultural laboratories, where macroanalysis may prove slow and cumbersome. It eliminates the need for a microbalance, for workers highly specialized in such manipulative technique, and for extreme purity of reagents. They claim that it avoids the disadvantages inherent in both macroanalysis and microanalysis, proving more sensitive and delicate than the former and more generally practicable than the latter. They give an account of their technique. While no new principles are involved certain new features are introduced, which will be of interest to those working on plant analysis.

351. Davidson, O. W., and Shive, J. W. 634.25-1.8
The influence of the hydrogen-ion concentration of the culture solution upon the absorption and assimilation of nitrate and ammonium nitrogen by peach trees grown in sand cultures.
Soil Sci., 1934, **37** : 357-86, bibl. 29.

The peach seedlings used were grown from pits from an open pollinated Early Crawford tree. Seedlings from this variety are said by the authors to be homozygous in many of their characters and to be nearly uniform in their habits of growth. Nitrogen was applied to these seedlings growing in sand cultures at pH 4, 6 and 8 in the form of ammonium and in the nitrate form. Absorption tests and analyses gave the following results. With NH_4 as the source of nitrogen better growth was made at pH6 than at pH4 or pH8, but with NO_3 as source pH4 was optimum for growth. The optimum growth in both the above cases was about the same. NH_4 nitrogen was absorbed at higher rates by trees supplied with solutions adjusted to pH6 than by those supplied with solutions at pH4. NO_3 nitrogen was always absorbed at higher rates by trees supplied with solutions adjusted to pH4 than by those with solutions at pH6 or 8. The pH values being favourable nitrogen was absorbed at a somewhat higher rate when supplied in the NH_4 than in the NO_3 form. The initial stages of ammonium assimilation by the peach take place in the roots. Nitrate reduction by peach trees takes place almost entirely in the roots. Good growth and high yield of plant substance were usually associated with relatively low percentages of protein nitrogen in stems and roots. They were also associated with relatively high percentages of amide, amino, and humin nitrogenous fractions. The stems of those trees which made the best growth and produced the highest yields of plant substance were relatively low in basic nitrogen, while the roots were relatively high in this fraction. [From authors' summary.]

352. Burrell, A. B. 634.11-1.67-2.1
The effect of irrigation on the occurrence of a form of the cork disease and on the size of apple fruits.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 415-20, bibl. 4.
This is a preliminary report on work carried out during the last 8 years in the Champlain Valley, N. York. The main symptom in all varieties was a diffuse browning of the flesh, especially near the core. Irrigation was found both to decrease the amount of cork and to increase the size of fruits.

353. Finch, A. H., and others. 632.191 : 634.1/3
A chlorotic condition of plants in Arizona related to iron deficiency.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 431-4, bibl. 1.
Notes on observations made to determine the exact cause of a malady of a large number of horticultural fruit and ornamental plants characterized by a chlorosis of the topmost leaves. It is noted that affected citrus trees which respond to treatment with iron may contain as much or more total iron than healthy trees. The problem would appear to be the maintenance of available iron in the tree. Various treatments designed to lower the pH of the plant tissue and thereby increase the solubility or availability of the iron in the tree are being made.

354. Chandler, W. H., and others. 634.1/8-2.19
Little leaf or rosette of fruit trees. II—Effect of zinc and other treatments.
Proc. Amer. Soc. hort. Sci., 1932, **29** : 255-63, bibl. 3.
Chandler, W. H., and others. 634.1/8-2.19
Little leaf or rosette of fruit trees. III.
Ibidem, 1933, **30** : 70-86, bibl. 4.
Treatment with various zinc compounds, applied to the soil, sprayed on or injected into the tree proved successful in combating this evil. The suggestion is made in the first paper that toxic substances from certain chromogenic soil bacteria may possibly be the cause of rosette and may be precipitated by compounds of zinc, mercury, silver and calcium. In the second paper [the third of the series, see *Ibidem*, 1931, 28 : 556, *H.A.*, 1932, 2 : 3 : 240—Ed.], an account is given of numerous experiments made in the hope of elucidating both the exact cause and the reason for success or failure of different treatments. The effects of spraying different kinds of fruit trees with zinc sulphate are noted and it was found that on peaches and apricots and possibly on plums, almonds and apples, spraying in autumn with a zinc lime mixture 16-6-100 or stronger, tends to cause normal growth the following spring in affected trees. Spraying was particularly effective on grapes and on citrus. The injection of zinc sulphate through holes some 1·5 in. deep, made with a $\frac{3}{8}$ in. bit, 3 to 4 inches apart round the trunk, continued to give more dependable results than any other treatment except spraying in the two cases of citrus and grapes mentioned above. The benefit lasted well through the second summer but seldom longer. There was indication that zinc dust and zinc oxide could be applied successfully in the same way. Experiments with zinc nails are as yet inconclusive. Injections made with some 13 other chemical compounds such as manganous sulphate, mercurous chloride etc., did not yield definite results. The authors consider that their experiments have at least eliminated the possibility of effecting a cure for little leaf by the application of calcium compounds, magnesium sulphate, aluminium sulphate or any of the common fertilizer elements. Their later results are nearly all in harmony with the view that little leaf is a symptom of deficiency of zinc for normal metabolism. Nevertheless, because of the suddenness of death of a healthy tree from little leaf, and because some trees have recovered without any conceivable improvement in the zinc supply, and further in view of the general susceptibility of large woody perennials and the general immunity of annuals grown in the same soil, they are not convinced that zinc deficiency is the only cause, this remaining still an open question.

355. Swarbrick, T. 634.11-1.542.27-1.55
Biennial bearing of apples. I. Blossoming and fruiting of individual spurs. II. The effect of blossom and fruit thinning.
Long Ashton Res. Sta. Ann. Rept. for 1933, 1934, pp. 37-47.
In the first part of this paper the author describes the spur performance of Lane's Prince Albert and of Worcester Pearmain. The former is a typical spur bearing variety, whereas Worcester produces the majority of its flowers in any one year at the ends of short 1-year-old shoots and is not prone to fall into the biennial habit. Biennial bearing is confined to spur bearing varieties and notably to those which are relatively precocious. In the second part of the paper are discussed the effects of various experimental thinnings of flowers and fruit on 14-year-old Early Victoria trees, which had been regularly pruned each year by tipping all leading shoots, removal of crossing and superfluous branches and occasional slight spur pruning. Treatments were (1) 50% blossom thinning. (2) Fruit thinned to 1 per truss. (3) Thinning for "early market" only, i.e. all fruits set were allowed to develop until picked over for early market. (4) Control. Five trees were submitted to the same treatment each year. Results, which are tabulated, have not differed sufficiently to allow of anything but a very general discussion and so far the several treatments have not materially influenced the onset of biennial bearing.

356. McCormick, A. C. 634.11-1.542.27-1.55
Control of biennial bearing in apples.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 326-9.
Attempts were made on Yellow Newtown and Ortley apple trees to reproduce artificially the natural fruiting habit of the annual bearing Anjou pear. The trees were 20 years old and received 5 lb. nitrate of soda each year. Treatments were :—nil—removal of $\frac{2}{3}$ of blossoms at blossoming time—removal of $\frac{3}{4}$ of the blossoms. Six weeks later at the regular fruit thinning time all three lots were reduced to the same comparative number of fruits per tree, namely approximately 3% of individual blossoms. In the following two years the check trees continued to show the biennial habit, while the result of the pre-thinning was very greatly to check this habit in the treated trees and to induce considerable blossom formation each year. This result is attributed to the considerable conservation of energy achieved by the treated trees as opposed to the controls. The latter in the on year set some 50% of the spurs and grew the fruit for 6 weeks before actual thinning eliminated it, and in the off year produced only a negligible quantity of blossom.

357. Harmon, F. N. 634.25-1.542.27
Relation of pruning and thinning to fruit size and yield of Paloro peaches.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 219-22.
In the Shafter district, California, where these tests were carried out, tremendous vegetative growth was made by 3 and 4-year-old trees as the result of heavy pruning. The various treatments were carried out on young 3-year-old trees. Trees that received medium light pruning (half growth thinned out and remaining shoots cut back a quarter) produced about 60 % more fruit of good commercial size than similar trees receiving heavier pruning. It is concluded that the cheapest thinning of the fruit is effected by pruning, hand thinning being a necessary accompaniment to adjust the number of fruits to the leaf area of the tree.

358. Kemmer, E. 634.11-1.542
Untersuchung über die Auswirkungen des Pflanz- und Nachjahrschnittes.
(Investigations on the effects of pruning at planting as compared with pruning a year after planting.)
Landw. Jb., 1934, **68** : 393-404.
The author discusses growth data obtained from some 24 first and second quality standard Landsberger Renette apple trees approximately uniform as to root and top development at time of planting, part of which were pruned in the same winter or spring in which they were planted and part not pruned till the following spring. These data lead him to the following conclusions :—(1) Pruning at the time of planting is successful under all circumstances. There

is no necessity for postponing for a year the pruning of weak trees or trees planted excessively late in the year. (2) Pruning after the lapse of a year may also be considered a useful practice. (3) Any differences noted in growth due to the adoption of one or other of these practices are found to vanish by the 3rd year, hence the reputed disadvantages of one or the other system are found to be unimportant. (4) The disadvantages of planting too early or too late in the season cannot be overcome by any particular pruning system. (5) The results of the two systems being found the same, choice should be governed by convenience, hence immediate pruning will generally be practised.

The following are also noted :—

KEMMER, E., AND SCHULTZ, F. Grundlagen obstbaulicher Planwirtschaft. (**Fundamentals of fruitgrowing economics.**) *Landw. Jb.*, 1933, **78** : 497-576, bibl. numerous. (A comparison of systems obtaining in different countries and the reasons thereof.)

KEMMER, E. Obstbau. (**Fruitgrowing.**) Reprint from the special number of *Wissenschaft und Landwirtschaft* on the occasion of the 50th Jubilee of the Landwirtschaftliche Hochschule, Berlin. (The writer deals briefly with German fruitgrowing from an historical and economic point of view.)

HIBBARD, A. D. **Metaxenia in the apple and squash.** *Proc. Amer. Soc. hort. Sci.*, 1933, **30** : 140-2, bibl. 4. [Results inconclusive.—ED.]

MACDANIELS, L. H., AND OTHERS. **The effect of various bactericides on the set of fruit and the germination of the pollen of the apple.** *Proc. Amer. Soc. hort. Sci.*, 1933, **30** : 26-31, bibl. 4.

CHANDLER, R. F. **A study of the effect of various potassium carrying fertilizers upon the growth and yield of apples and peaches.** *Proc. Amer. Soc. hort. Sci.*, 1933, **30** : 67-9.

ALDRICH, W. W. **Pear fruit thinning in relation to yield and size of fruit for the same season.** *Proc. Amer. Soc. hort. Sci.*, 1933, **30** : 332-40, bibl. 14.

MANVILLE, I. A. **Food values and vitamins in pears.** *Oregon State Hort. Soc. 25th Ann. Rept.*, 1933, pp. 47-62.

SMALL FRUITS, VINES, NUTS.*

359. THOMPSON, C. R. 634.711

Raspberry varieties. An identification key and notes on varietal characters.

Long Ashton Res. Sta. Ann. Rept. for 1933, 1934, pp. 48-59, bibl. 5.

Observations for two further years confirm the opinions expressed in a previous report (*Ibidem* for 1930, 1931, *H.A.*, 1931, 1 : 2 : 161) on the varieties under trial at Long Ashton. In the present paper a key and notes are given which should help growers to name varieties correctly and at the same time detect rogues. In table I varieties are grouped into 3 colour groups, viz. red, white and light brown, according to the colour of the mature canes. In table II they are further grouped according to the colour of the spines which occur on the young developing canes. In table II (A) varieties are further classified according to cane habit, whether vigorous or dwarf, erect or straggling. Short distinguishing notes are then given of some 29 varieties classified previously in the above manner, and in some cases on susceptibility and freedom from mosaic. Varieties particularly selected for general approval include Pyne's Royal, Preussen, Herbert, Norfolk Giant, Improved Beehive, Lloyd George, Red Cross.

360. BEAKBANE, A. B. 634.713/4

A note on the training of loganberries and blackberries.

East Malling Res. Sta. Ann. Rept. for 1933, **A.17**, 1934, pp. 247-9, bibl. 2.

Four different methods are illustrated and discussed. The aim has been, by training the young cane away from or above the fruiting cane, to make it more difficult for spores of the cane spot disease (*Plectodiscella veneta*) from the fruiting cane to find their way on to the new cane. Actual effects on the incidence of the disease are not yet available.

* See also 499.

361. Howells, D. V. 634.75
Strawberry culture, I and II.
Scott, J. Agric., 1934, **17** : 153-66, and 287-93.
In part I the author discusses first such general points as soil, climate, aspect, drainage, rotation, preparation of soil, manuring, methods of planting, and then proceeds to a consideration of the actual operations necessary for successful cultivation. He concludes with hints on picking, packing and marketing. In part II he deals with the following diseases, pests and murrains and advises on their control :—Red core disease (*Phytopthora* sp. Alcock)—Lanarkshire strawberry disease, Tarsonemid mite (*Tarsonemus fragariae*), the Yellow edge virus disease.

362. Davis, M. B., and others. 634.75-1.8
Nutritional studies with fragaria. II.* A study of the effect of deficient and excess potassium, phosphorus, magnesium, calcium and sulphur.
Sci. Agric., 1934, **14** : 411-32, bibl. 8.
Parson Beauty was the variety of strawberry used throughout. The plants were grown in the field from the time the young stolons rooted until the following spring when they were lifted, size graded and transferred to 6 inch ordinary clay pots. The medium used was finely ground sandstone. The experiment was made with 3 separate batches of material in 3 separate years and results are based on observations spread over that time. Forty-six different treatments were given, which may be divided into 5 main groups, viz. the potassium, the phosphorus, the magnesium, the calcium and the sulphur group, each of these being subdivided into an excess section and a deficiency section. The methods of applying the nutrient solutions and their exact composition are described. Among other results recorded were the following :—Lack of winter hardiness was associated more markedly with deficient potassium than with any other treatment. Yield data suggest that reduced fruit bud formation may have been caused by excess phosphorus and excess calcium. Fruit bud formation was markedly affected by complete omission of phosphorus and magnesium but not by that of calcium and sulphur. There was indication of marked influence of potassium in carbohydrate accumulation. The ash and dry matter content was markedly affected by difference in nutrient treatment. Antagonism was revealed between calcium and potassium and between phosphorus and potassium. There was a lack of low potassium and low phosphorus symptoms in the foliage in the series where calcium magnesium and sulphur were omitted. The following correlations were found :—negative between CaO and K_2O in ash, positive between MgO and P_2O_5, negative between K_2O and MgO, and negative between P_2O_5 and K_2O in ash.

363. Hoagland, D. R., and Snyder, W. C. 634.75-1.8
Nutrition of strawberry plant under controlled conditions : (a) effects of deficiencies of boron and certain other elements : (b) susceptibility to injury from sodium salts.
Proc. Amer Soc. hort. Sci., 1933, **30** : 288 : 94, bibl. 1.
The leaf symptoms shown by strawberry plants grown in culture solutions containing inadequate boron are similar to those observed in certain strawberry areas in California. An incidental observation was made in one experiment that plants growing in the culture solution to which enlarged supplementary amounts of boron had been added were almost completely free from mildew and red spider, while those growing in solutions less adequately supplied with boron were correspondingly more heavily attacked. Phosphatic deficiencies were shown in purple tints in the leaves. Potassium deficiencies were observed not so much in marginal scorch as in the bronzing and necrosis of the petiole and the base of the leaf. As regards sodium the experiments lead to the general conclusion that heavy irrigation of strawberry beds conduces to the accumulation of sodium salts and that some varieties are highly sensitive to even moderate concentrations of sodium.

* The first article appeared in *Sci. Agric.*, 1928, Vol. 8, No. 11.

364. Clark, J. H. 634.75-1.415
Reaction of the nutrient medium as affecting growth of strawberry plants.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 283-7, bibl. 4.
Howard strawberries were grown in nutrient solutions in which the nitrogen was supplied in the form of calcium nitrate or ammonium sulphate at different pH values. The greatest total growth was made when the solution was kept at pH 4·6 in the case of calcium nitrate being used and at pH 6·4 when the source of nitrogen was ammonium sulphate.

365. Zimmermann, E. 634.8 : 581.082.4
Ein Beitrag zur exakten Versuchsanstellung im Weinbau. (**The lay out of viticultural experiments.**)
Gartenbauwiss., 1934, **9** : 713-69, bibl. 23.
The author first discusses previous work done to determine the factors which make for reliability in viticultural trials and then proceeds to consider in turn the different sources of error and how they may be avoided. He sums up as follows :—(1) For performance trials only the best ripened fruitful wood derived from good bearers should be used. This should be obtained in the dormant state and planted out in a uniform nursery and before bringing into the trial should be submitted to a very strict selection. (2) The more uniform the pruning has been, the more readily will differences between individual stocks be levelled up. (3) Where short pruning is adopted, differences between individual stocks are appreciably greater than where pruning is done leaving several rods. (4) Features showing varietal differences to a marked degree are :—(*a*) Number of buds, (*b*) length of internodes, (*c*) cropping capacity of individual buds. (5) In their initial trials clones should be judged on their average crop for several years with particular reference to yearly variation. (6) After elimination in these trials of up to 75% of the plants the residue are resubmitted to further trial. Here differences in cropping of 12·9% and more per year may be found between two clones. (7) The differences in cropping are plotted out and the curve shows any skewness that occurs. (8) Individual errors are eliminated by the use of 60 plants in Rheinhessen and in the Palatinate of 75-100 plants. In one vineyard of mixed clones at Serrig individual error was sufficiently low when only 50 plants were used. (9) Six repetitions of 60 plants per plot in Hessen and of 50 plants in the Saar resulted in a sufficient accuracy. Further increasing the size of plots did not increase the reliability of results. (10) On the average of all trials cropping differences of 6·5% and higher could be determined with certainty. (11) Generally speaking repetition of plots tends to increase reliability of results more than does increasing size of plots. (12) On level ground chessboard, square plots are best, on uneven ground plots consisting of long rows are preferable. (13) To obviate the disadvantages of a large trial area, the establishment of check plots and the formation of trial groups are very desirable. (14) In order to obtain reliable results pruning should not be any more severe next to gaps than elsewhere.

366. Branscheidt, P. 634.8-1.535
Zur Frage der Determination der Internodien in verschiedener Höhe des Jahrestriebes bei der Rebe u. ihre Bedeutung für Rebenveredlung u. Rebenzüchtung. (**The determination of internodes at different heights in the current year's growth of the vine and their importance in grafting and breeding work.**)
Gartenbauwiss., 1934, **8** : 515-72, bibl. 31.
Observations were made on a large scale (some 969 culture beakers) on the following vines grown in water cultures :—(1) European vines, Riesling, Sylvaner, and Müller Thurgau, and (2) the Americans, 5BB and 8B, both being Berlandieri × Riparia crosses, and 1616, a Solonis × Riparia cross. Among the conclusions drawn by the author from his experiments are the following :—As regards budgrowth, the later growth continues into the winter, the shorter will be the period of spring growth. The European varieties need a pH of 4·8-6·3 for normal development. The American crosses do best in a neutral to weakly alkaline culture solution. The optimum salt concentration in solution when growth was at its height was ·05%. It was clearly shown in every trial that optimum bud development is only given by cuttings from the

buds on internodes 4-12, growth from more highly placed buds being weaker and often failing entirely in lower ones. The period of greatest growth is physiologically very firmly anchored in the current year's growth and was most noticeable in the growth of cuttings. Root development is governed by the same laws as bud formation. The character of the growth of the cutting is determined by the position of the cutting on the current year's growth.

367. BRANAS, M., AND OTHERS. 634.8-1.541.11-1.535
Recherches sur les porte-greffes ; la reprise du bouturage. (**Vine rootstocks and their ability to root from cuttings.**)
Ann. Ec. Agric. Montpellier, 1933, **22** : 311-24, bibl. 5.

The authors discuss the results they have obtained in one year's trial of the capacity of the members of some 14 groups of cuttings to strike under fair but not extremely favourable nursery conditions. A very great difference is found to exist between the striking capacity of the different groups and between members of the same group of hybrids. Results are tabulated and given as percentages of the total number of cuttings planted. Even cuttings from one and the same vine showed differences in performance. The reason for such differences are discussed. Possible factors suggested are systems of planting and after care, ripening of wood, treatment during period between removal from vine and setting in ground. Certain hybrids which have in other respects excellent qualities as rootstocks do not strike readily and methods of facilitating the process are discussed. Experience shows that the best hope lies in hybridization and it is noted that, where breeding is thus used, it is necessary to select from the F2 generation. The methods of taking cuttings very early, i.e. before the fall of the leaves, or late, i.e. after branching has taken place, have given success on a small scale but demand considerable and skilled attention and do not commend themselves to common practice. Again, layering has been recommended, but experiments at Montpellier [apparently very few.—ED.] show little advantage gained and the writers do not advise it. Little success has, moreover, resulted from treatment with large amounts of water, nitrate of potassium, etc.

368. KROEMER, K., AND SCHANDERL, H. 634.8 : 581.035.3 : 632.951/2
Quantitative Untersuchungen über die Strahlungsdurchlässigkeit von Spritzbelägen der gebräuchlichsten Schädlingsbekämpfungsmittel des Weinbaus. (**Quantitative trials on the obstruction offered to light rays by deposits of common spray materials used on vines.**)
Gartenbauwiss., 1934, **8** : 672-84, bibl. 14.

The authors' investigations show that the ordinary functions of the vine leaf are often seriously upset by a dark or thick layer of spray deposit such as that of the ordinary bordeaux mixture used in German vineyards. It is noted that this interception of the sun's rays has generally a bad effect on crop production, but that in years of great heat and little rain such a spray deposit may be useful and desirable.

369. WINKLER, A. J. 634.8-2.111
The treatment of frosted grape vines.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 253-7.

Frosts in Merced County and in San Joaquin County in 1932 and 1933 allowed tests to be carried out of the efficacy of Perold's* recommendations for treatment of frozen vines. It was found that the efficacy varied with different types of grape vine according to their habit of growth and that treatment should vary according to differences in habit of growth and of extent of injury. As a result of these investigations Winkler recommends that when only the tips are frosted no action should be taken. When the shoots are killed to just below the flower cluster, the injured shoots should be removed on varieties where one or more lateral growing points of the dormant bud are fruitful as well as the primary growing point, but no action taken in the case of vines in which only the primary growing point is fruitful, unless it is wished to improve the fruiting wood. In this case the canes should be cut back to 4-5 buds. When the shoots are entirely killed no action should be taken.

* *A treatise on viticulture*, 1927, Macmillan, pp. 430.

370. UPSHALL, W. H., AND VAN HAARLEM, J. R. 634.8-1.542
Yield and quality of fruit from strongly vegetative Concord grape vines.
Sci. Agric., 1934, **14** : 438-40.

This is a progress report of experiments started at Vineland in 1929. Each plot contains 18 vines, which are pruned on the 6-arm Kniffen system. Every third plot has received no fertilizer since the start of the experiment, and the data presented here are taken from these plots only. They indicate that by over pruning strong growing grape vines growers are reducing not only the quantity, but also the quality of the crop, since they encourage thereby a later ripening fruit, which is not desirable in the Niagara peninsula.

371. LAGATU, H., AND MAUME, L. 634.8-1.8 : 581.192
Recherches sur le diagnostic foliaire. Receuil des notes* insérées aux *Comptes rendus de l'Académie des Sciences*, 1924-33. (**Investigations on leaf diagnosis. Collected notes from the *C.R. Acad. Sci. Paris*,** 1924-33.)
Ann. Ec. Agric. Montpellier, 1933, **22** : 257-310.

The notes are inserted without change and without comment. They deal with the following particular subjects (translated titles) :—The remarkably regular development of certain physiological ratios (lime, magnesium and potassium) in the leaves of a well manured vine. Investigations of the effect of lime, magnesium and potassic fertilizers on the vine by means of periodic analysis of leaves.—Linear relation between successive amounts of phosphoric acid and of nitrogen contained in the leaves of a well manured vine.—Diagnosis of nutrition of a plant based on the chemical development of a suitably chosen leaf.—Control of the mode of nutrition of a perennial plant (grape vine) in a particular soil receiving a particular manurial treatment.—Leaf diagnosis and its accuracy.—Observation by means of leaf diagnosis of the mutual, physiological replacement of the two bases, lime and potash.—Comparative chemical development of vine leaves selected at different heights on the branches.—Observation by means of leaf diagnosis of the influence of temperature on plant nutrition.—A definite response given by leaf diagnosis where other means of observation failed.—Variation in physiological relations between the mineral constituents of a plant species.—Variations in nitrogen content at particular points in the foliage of the vine.†—Leaf diagnosis as a means of determining the exact manurial treatment necessary to restore a starved vine.†—Can the leaf receive an overdose of mineral food without profit to the growth of the plant [in this case a potato.—ED.].—Comparative composition of homologous leaves taken from fruit bearing vines and from vines from which the fruit had been removed.†—Comparative composition of the dry matter of homologous leaves from fruitful and from naturally sterile branches of the vine.†—Nutritional variation in cultivated plants under conditions of practical agriculture in the absence of fertilizers.

372. TRAUB, H. P., AND MULLER, H. J. 537.531 : 634.521
X-ray dosage in relation to germination of pecan nuts.
Bot. Gaz., 1934, **95** : 702-5, bibl. 6.

The varieties used in the trials were Halbert and Payne. Treatments were given by the Victor Company broad-focus Coolidge tube with tungsten target and Snook transformer at 50 kilovolts peak and 10 milliamperes, through a screen of aluminium 1 mm. thick, at a distance of 14 cm. from the target. Treatment varied from 0 to 160 minutes. Preliminary results suggest that the maximum dosage consistent with a reasonable percentage of germination, i.e. 20%, probably lies between 40 and 80 minutes exposure under the conditions of the experiment.

The following also are noted :—

STENE, A. E. **Preliminary studies in the fertilization of red raspberries.**
Proc. Amer. Soc. hort. Sci., 1933, **30** : 275-7.

MOOG, H. Untersuchungen über die Variabilität des sortentypischen Blattes von *Vitis* L. (**Trials of the variability of leaves typical of varieties in *Vitis*.**)
Gartenbauwiss., 1934, **8** : 685-712, bibl. 8.

* Any or all of these could be translated on request.
† Already abstracted *H.A.*, 1933, 3 : 3 : 321-4.

HOUDAYER, C. Experimentation d'engrais chimiques sur vigne. **(Fertilizer experiments with the vine.)** *Prog. agr. et vit.*, 1934, **101** : 179-81.

BEARD, F. H. **Cultural trials with hops. I. The effect of distance of planting and number of bines per string—a progress report.** *East Malling Res. Sta. Ann. Rept. for 1933*, **A.17**, 1934, pp. 132-6, 1 reference.

HAMOND, J. B. **Some recent investigations into methods of storing walnuts during the winter.** *East Malling Res. Sta. Ann. Rept. for 1933*, **A.17**, 1934, pp. 259-62.

PLANT PROTECTION OF DECIDUOUS FRUITS.*

373. OGILVIE, L., AND OTHERS. 634.75-2.8

A note on a strawberry disease resembling the American " crinkle ".

Long Ashton Res. Sta. Ann. Rep. for 1933, 1934, pp. 96-7, bibl. 7.

The authors show 3 plates illustrating the disease found by them in commercial plantations in the south-west of England. The disease seems to be identical with that described by Zeller and Vaughan in the United States. It would appear to be of a virus nature.

374. ADAMSON, N. J. 634.11-2.111

Russet on apples.

N. Z. J. Agric., 1934, **48** : 300-1.

A description accompanied by photographic illustrations of the kind of russeting in apples which is due to frost. Frost russeting has been attributed to many other causes, but the author considers that the heavy type of russeting around the calyx is an indication of frost injured flesh within. This is usually accompanied by a characteristic flattening of the calyx end of the apple.

375. GLOYER, W. O. 634.11-2.314

Crown gall and hairy root of apples in nursery and orchard.

Bull. N. Y. St. agric. Exp. Sta., **638** : 1934, pp. 30, bibl. 14.

By substituting budding for grafting the heavy losses once associated with the incidence of crown gall and graft overgrowths have been largely eliminated. Trials on the effects of inoculating growing trees with crown gall and hairy root were not conclusive. Thus infected Wealthy trees showed the smallest trees of any group, but infected McIntosh trees grew just as well as the controls. As regards rootgrowth both hairy root and crown gall tended to produce a one-sided root system. It would not, however, appear that any relaxation or modification of the existing regulations is yet desirable.

376. HILDEBRAND, E. M. 632.314 : 634.11

Life history of the hairy root organism in relation to its pathogenesis on nursery apple trees.

J. agric. Res., 1934, **48** : 857-85, bibl. 42.

RIKER, A. J., AND HILDEBRAND, E. M. 632.314 : 634.11

Seasonal development of hairy root, crown gall and wound overgrowth on apple trees in the nursery.

Ibidem, 1934, **48** : 887-912, bibl. 14.

RIKER, A. J., AND OTHERS. 632.314 : 634.11

Hairy root, crown gall and other malformations at the unions of piece-root-grafted apple trees and their control.

Ibidem, 1934, **48** : 913-39, bibl. 50.

The origin, methods of dissemination and control measures against *Phytomonas rhizogenes* are probed deeply in these three papers, though it would be optimistic to suggest that any safe and

* See also 352, 353, 354, 369, 478, 479, 480, 494, 500, 501.

certain preventive of its occurrence is as yet forthcoming. In the first paper it is concluded that shipments of nursery stock play a large part in disseminating the disease. The seedling root is found to be one medium of transmission and grafting time would appear to be the time when the principal primary infection takes place. The presence in the soil of primary infections resulting from the entrance of the bacteria at grafting time together with the various wound producing agencies are the factors which would seem to account for the secondary spread of the disease. In the second lot of investigations, in which the seasonal development was followed during three seasons, the evidence pointed to the importance of soil insects, including white grubs, wireworms and fungus gnats in opening up infection courts for bacteria during the growing season. Most of the natural infection seemed to be correlated with warm weather, active growth of nursery trees, short incubation periods, decreased protection of the unions by wrappers and insect activity. In the third paper measures of control are discussed. The authors consider that antiseptic treatment of seedlings carrying the bacteria responsible seem to promise some measure of control. Adhesive tape wrapping appeared to be better than other types of wrapping tested and to be the most important single factor among control measures. Tape wrappers did not, however, prevent infection at the time when the grafts were made.

377. Banfield, W. M. 632.314 : 634.711

Life history of the crown gall organism in relation to its pathogenesis on the red raspberry.

J. agric. Res., 1934, **48** : 761-87, bibl. 43.

Given suitable moisture conditions crown gall organisms are given off continuously from the surface of living crown galls. The bacteria were found to overwinter in the soil of fallow fields in Wisconsin and to exist in a pathogenic state for 14 months in unsterilized soil. It is impossible to detect incipient, undeveloped infections on the raspberry, a fact which would account for the spread of the disease to new areas in apparently healthy canes. Infection occurs only through injuries. Injuries made may apparently remain susceptible to entry for a long time, even up to 7 weeks. The period of incubation of the disease varied from 11 to 28 days according to environmental conditions, mainly seasonal. Among other insects found to cause the injuries necessary for entry of the disease were root feeding arthropods and white grubs. [From author's summary.]

378. Marsh, R. W. 632.42 : 634.11

A summary of recent investigations on apple scab.

Long Ashton Res. Sta. Ann. Rept. for 1933, 1934, pp. 88-95, bibl. 18.

The author gives a digest of the more important recent papers on the subject as they touch on the following :—scab infections on the shoot, spread of infection in spring, times for spraying, spray damage, choice of fungicide, spray programme.

379. Goodwin, W., and others. 634.11-2.42

The control of apple scab : Allington Pippin and Newton Wonder, 1933.*

J. S. E. agric. Coll. Wye, 1934 : **34** : 136-44, bibl. 7.

In the previous year bordeaux mixture was compared with mustard oil-bordeaux. This year cotton seed oil-bordeaux was tested against bordeaux mixture. It was found to be equally fungicidal and to cause less " russeting ". It is considered worth trying on a commercial scale. As before the scab was worse in the Newtons than in the Allingtons. The possibility of a specialized form of the fungus is suggested.

380. Martin, H., and others. 634.13-2.42

Spraying experiments against pear scab.

J. S. E. agric. Coll., Wye, 1934, **34** : 145-54.

Scab was efficiently controlled on Louise Bonne, Williams Bon Chrétien, Marguérite Marillat and Doyenné du Comice by 1 pre- and 2 or better 3 post-blossom applications of either ordinary bordeaux mixture or by cotton seed oil-bordeaux emulsion. Both caused damage to the foliage of the two last named varieties.

* See *Ibidem*, 1933, 32 : 95, *H.A.*, 1933, 3 : 3 : 329.

381. DRUMMOND, R. 632.41 : 634.11 +634.22
Notes on the wither tip disease of plums caused by *Sclerotinia cinerea* and on the blackening of apples caused by *Sclerotinia fructigena*.
J. Pomol., 1934, **12** : 105-9, bibl. 6.

A. *Plums*. Attempts were made to bring about infection of shoots of plums by various methods. (1) Inoculations of shoots on plums growing in pots and free from aphides were unsuccessful in the greenhouse unless the tissues were punctured. (2) Few inoculations in the open were successful, probably owing to the prevailing dry weather. (3) Inoculations of punctured and unpunctured cut shoots kept in a greenhouse were successful even in the absence of aphides. (4) Young leaf laminae and petiolar glands were the most readily affected parts of the shoots. Mature leaf laminae never became affected. B. *Apples*. (1) Blackening of old apples was produced by *S. fructigena* whether isolated from black or from brown rotted apples. (2) Blackening of young and old apples was produced by *S. cinerea* isolated from Morello cherry blossoms. [From author's summary.]

382. VIALA, P., AND MARSAIS, P. 632.4 : 634.8
Sur le court-noué, maladie parasitaire de la vigne. (**Court-noué, a parasitic vine disease.**)
C. R. Acad. Sci., Paris, 1934, **198** : 26-9.

Court-noué is characterized morphologically in particular by a stunting of the plant and excessive secondary branching, which gives it a bushy appearance. The internodes are very short, the nodes are often touching and imbricated, the leaves are small and laciniate, the flowers are abortive. The plant shows a progressive decline in vegetative growth from year to year. It is probably due to several causes, some of which are known. The most frequent cause—responsible for the phenomenon known as " roncet ", " mal nero ", etc.—is *Pumilus medulla* nov. sp. according to the present authors, who explain the fact that the discovery has not been made previously as due to the neglect of investigators of the internal lesions, which are highly characteristic but are very easily missed. These lesions are described. It is noticeable that the parasite will not develop in cultures where arsenicals are present even as low as 1 to 1,000. Suggestions are made regarding treatment.

383. HILDEBRAND, A. A. 634.75-2.4
Recent observations on strawberry root rot in the Niagara peninsula.
Canad. J. Res., 1934, **11** : 18-31, bibl. 13.

The investigations reported on here have centred largely on isolations from and critical microscopical examination of roots of affected (and healthy) plants. The work which has been in the nature of a preliminary survey has sufficed to indicate that fungi particularly and possibly nematodes are two of the more important members of a complex of factors responsible for strawberry root rot. Representatives of the genera *Fusarium*, *Ramularia* and *Pythium* were isolated most often from diseased roots, but it is at present impossible to evaluate the significance of their association with the diseased condition found. Fungi isolated as far as is known for the first time from *Fragaria* spp. include *Cylindrocladium* and *Helminthosporium*. Indication is given that temperature and humidity considerably affect the incidence of root rot. Two fungi, one of the characteristic phycomycetoid type, the other of the *Rhizoctonia* type, were found to occur almost without exception on all strawberry roots.

384. TRUSCOTT, J. H. L. 634.75-2.4
Fungous root rots of the strawberry.
Canad. J. Res., 1934, **11** : 1-17, bibl. 25.

A report on investigations at Vineland, Ontario. Roots were collected periodically throughout two growing seasons and were studied microscopically and plated. Very numerous isolates from diseased roots were tested by artificial inoculation of strawberry roots and the primary parasites were studied further. These were classed in the following genera :—*Pythium*, *Fusarium*, *Alternaria*, *Ramularia*, *Rhizoctonia*, *Verticillium* and *Cylindrocladium*. Three additional forms were

also revealed by the microscope, namely, *Asterocystis*, a plasmodiophoraceous fungus and the phycomycetous mycorrhizal fungus. Some were more common than others and in most of them activity varied with the season. A similar root flora was found in wild strawberry roots. Their relative importance still needs investigation. [From author's summary.]

385. Davies, C., and Smyth-Homewood, G. R. B. 632.94
Investigations on machinery used in spraying. Part I. Nozzles.
J. S. E. agric. Coll., Wye, 1934, **34** : pp. 39-62, bibl. 4.

The authors review the present position concerning the available knowledge of nozzle-output in relation to efficient and economical spraying. They record the need for fundamental research on the engineering side of the problem in view of the lack of accurate information as to what the requirements of spraying machinery are. Apparatus was devised for testing nozzle-output under definite standardized conditions. "Stationary" and "traverse" patterns of the types of spray obtained with different nozzle-settings were permanently recorded. They were described according to (1) shape, (2) symmetry, (3) atomization, (4) density, (5) irregularities, (6) diameter. Nozzle-discs at present in use were found to be very variable. The orifices, even of new discs with given orifice-size, varied in diameter, circularity, centricity and angularity. Accurate tests were impossible with such variable material, and a set of standard discs for experiment was made of a non-rusting metal. Four types of nozzle (described) were used. Variations in the diameter of the disc orifice influenced the diameter of spray-cones and the carry, but had no effect on atomization. Irregularities in shape of the disc and in the countersunk portion adversely affected the spray-cones. The diameter of the spray-cones and the atomization were inversely affected by the thickness of the disc. Increases in pump pressure increased atomization, carry and back pressure gave greater output and affected the diameter of the spray-cones. The disadvantages were increased losses due to leaks, breakdown of parts not designed to withstand the greater stresses, and loss of symmetry and uniformity in the spray-cones. Increases in depth of the eddy-chamber or in size of the vortex openings increased carry, output and back pressure, but decreased atomization and diameter of the spray-cones. Irregularities in shape or disposition of the vortex openings caused irregularities in the spray-patterns. In general, the greater the carry, the less the loss of spray-liquid (caused by gravity and air resistance) at given distances. The symmetry of the spray-cones was more or less retained at distances of 3 ft. and less : beyond this, the stationary patterns generally lost their regular shape. The paper contains twelve text figures and four tables. M.H.M.

386. Davies, C. 632.94
A method to determine the surface area of trees covered by spray-fluid, and to obtain a permanent record of the degree of fineness of the deposit.
J. S. E. agric. Coll., Wye, 1934, **34** : pp. 252-3.

Examination of natural leaves (whether fresh or preserved) for visible spray-deposit was unsatisfactory. Transparent celluloid discs, 2 inches in diameter, were used as artificial leaves and, secured by small spring clips, were hung in large Bramley's seedling apple trees. After spraying, the discs, bearing a visible deposit of spray, were removed for examination at leisure. The discs were suitably treated with chemicals, making the spray-deposit more visible. They were also used as photographic negatives. The percentage of cover obtained was gauged by eye, but it is suggested that a photo-electric-cell technique might be evolved. M.H.M.

387. Martin, H., and Salmon, E. S. 632.952
The fungicidal properties of certain spray fluids. XI. Synthetic solvents.
J. agric. Sci., 1934, **24** : 469-90, bibl. 15.

Manufactured hydrocarbons and their simpler hydroxyl-derivatives and esters have been tested for their fungicidal power on the hop mildew, *Sphaerotheca humuli*, and for any damage which they may cause to the leaf of the hop. Results are recorded here.

388. Editor. 632.951.1
Derris root as a Netherlands India export product.
Malay. agric. J., 1934, **22** : 236-8.
An abstract is given of an article by D. R. Koolhaas in the *Economic Bulletin of Netherlands-India*, Vol. 1, No. 3, 1934, on the subject of derris root. In the article the value of derris as a powerful insecticide, non-poisonous to man and animals, is stressed. Its insecticidal properties are attributed to the rotenone contained in it. The necessity for planters of a derris for commercial purposes with a guaranteed rotenone content of not less than 3% is stressed. Methods of distinguishing good forest grown derris roots are described. An account is given of methods of cultivation, selection of stock and harvesting. The only other plant of importance containing rotenone in sufficient quantities is *Lonchocarpus Nicou* from S. America. Derris is of more importance as it contains a higher proportion of other substances that have the same effect as rotenone. The possibilities of derris cultivation as a paying proposition for the Dutch East Indies is discussed. The editor of the *Malayan Agricultural Journal* states in a footnote that the Department of Agriculture S.S. and F.M.S. does not admit that there is conclusive evidence that rotenone is the most important toxic constituent of derris root, nor does it necessarily agree with the views on the chemistry of the toxic substances put forward in the article.

389. Gentner, L. G., and Norris, R. K. 632.951.4 : 634.1/2
Dormant sprays and their use for the control of insect pests of fruit trees in the Rogue River valley.
Bull. Ore. agric. Exp. Sta., **321**, 1933, bibl. 55.
An account of the use of these sprays chiefly on apples and pears. Considerable success was achieved in the control of the San José scale and of the pear leaf blister mite by the use of mineral oils having a viscosity range of 100 to 120 seconds Saybolt and sulphonation test of from 50 to 70%.

390. Overley, F. L., and Overholser, E. L. 632.951.23 : 634.11
Arsenic injury of apples.
Pop. Bull. Wash. St. agric. Exp. Sta., **149**, 1934, pp. 20, bibl. 6.
Among causes contributing to arsenic injury are :—faulty spray programmes during the growing season ; damage to skin texture done by other agents such as drought spot, aphis or mite injuries ; moisture collection on fruit after harvesting ; improper washing equipment—" proper washing equipment for sodium silicate* means a machine so constructed that, first, it will handle adequate foam as developed by the addition of soap, second it will give an abrasive action with underneath brushes, third it is provided with a heavy, forceful overhead flood system of agitation and fourth it has excellent rinsing facilities "— ; too high concentrations of washing solutions ; immersion in washing solutions for too long a time at too high a temperature ; inadequate rinsing after washing ; injuries on unwashed fruit.

391. Stapley, J. H. 634.11-2.78
The apple fruit miner (*Argyresthia conjugella* Zell.).
J. S. E. agric. Coll., Wye, 1934, **34** : 87-92, bibl. 6.
This moth has caused considerable damage in a localized area near Canterbury recently. An account of its life history in this locality is given. Observations made in other countries that it prefers mountain ash and only turns its attention to apples when the former is insufficient are confirmed.

* The authors consider this the best washing solution.

392. KEARNS, H. G. H., AND OTHERS. 632.793 : 634.11
Further observations on the joint control of the apple sawfly and apple scab—season 1933.
Long Ashton Res. Sta. Ann. Rept. for 1933, 1934, pp. 60-5, bibl. 5.
Spraying Worcester Pearmain apple trees with a nicotine wash (8 oz. to 100 gallons water) 7 days after petal fall, a treatment which in two previous years* had proved efficacious, was not so successful in 1933. The addition of lime-sulphur to a nicotine-Agral I wash did not cause a reduction in the toxicity of the nicotine. Attacks of scab being negligible no data were obtained on the effect of adding a wetter to the wash. The addition of lead arsenate to a nicotine-lime-sulphur-Agral I wash considerably decreased infestation.

393. HEY, G. L., AND STEER, W. 632.793 : 634.11
Miscellaneous observations on apple sawfly (*Hoplocampa testudinea* Klug.) in 1933.
East Malling Res. Sta. Ann. Rept. for 1933, **A.17**, 1934, pp. 234-42, bibl. 10.
During the course of investigations on the apple sawfly carried out in 1933 circumstantial evidence was obtained which pointed to the occurrence of an extra (sixth) instar in larvae which become females. Larval migration (with consequent secondary attack on the fruits) was found to occur at an earlier stage of larval development than has formerly been supposed. The migrating larvae were controlled to varying degrees by applications of a derris dust, nicotine and soap, and derris and soap. The larvae were found to construct their cocoons chiefly in the top 4 in. of soil. Data on relative susceptibility to sawfly attack showed that mid-season were more susceptible than early flowering varieties, but not much more susceptible than late flowering varieties. [Authors' summary.]

394. HASEMAN, L. 632.78
The codling moth problem in Missouri.
Bull. Mo. agric. Exp. Sta., **334**, pp. 16.
This report is a summary of the findings and results of experimental work done by the entomological department during the last 20 years. A moderately heavy spray programme is recommended where infection is not very serious. It should include 2 to 3 lb. arsenate of lead to 100 gallons fungicide with the usual fungicide in the calyx spray and 2 or possibly 3 first brood cover sprays, and 2 lb. arsenate of lead to 100 gallons in 2 or possibly 3 cover sprays properly timed for second and third broods. More arsenate is necessary where infection is more serious. Moth proofing the packing shed is recommended. Tree bands especially chemically treated corrugated paper bands are advisable for older trees but are apt to injure young smooth-barked trees.

395. HEY, G. L., AND MASSEE, A. M. 632.782 : 664.85.035.1
Observations on the effects of various gas mixtures of known composition on *Tortrix* larvae in store.
East Malling Res. Sta. Ann. Rept. for 1933, **A.17**, 1934, pp. 231-3.
Of seven different mixtures tried, that containing 2·5% O_2, 10% CO_2 and 87·5% N_2 was the most successful in preventing damage to the fruit by the larvae and in its lethal action on the larvae. The authors suggest that this was probably due to the low percentage of oxygen contained.

396. HEY, G. L., AND OTHERS. 632.768 : 634.11
An experiment on the control of the apple blossom weevil (*Anthonomus pomorum* (L) Curt.) by means of a derris dust.
East Malling Res. Sta. Ann. Rept for 1933, **A.17**, 1934, pp. 217-19.
The rotenone content of the dust was 0·14 to 0·15% in terms of crude rotenone and 0·13% as re-crystallized rotenone. The dust halved the injury caused by weevil when applied at the green bud stage, but had no appreciable effect when applied a week earlier. Possible reasons for failure of the earlier application are discussed.

* *Ibidem*, for 1931, p. 112, for 1932, p. 90, *H.A.*, 1932, 2 : 3 : 258 and 1933, 3 : 3 : 346.

397. GREENSLADE, R. M., AND OTHERS. 632.753 : 634.11
A progress report on the causes of immunity to the apple woolly aphis (*Eriosoma lanigerum* Hausmann).
East Malling Res. Sta. Ann. Rept. for 1933, **A.17**, 1934, pp. 220-4, bibl. 9.
Investigations are being made on the nature of some substance in a tree which confers susceptibility or immunity to the pest. There is indication that it is insoluble in alcohol but soluble in ether. Further trials are in progress to confirm or refute this supposition. A yeast so far found constantly associated with woolly aphides has been identified as *Torula rubra*. Its function is being investigated.

398. MCKAY, R. 634.11-2.753
Injury to apple trees due to paraffin oil used for the control of woolly aphis.
J. Pomol., **1934, 12** : 167-76, bibl. 5.
The common practice of treating woolly aphis with paraffin would appear to be dangerous both when applied in the summer and in the dormant season. In experiments made by the author on some 18 commercial varieties, of which Beauty of Bath and Newton Wonder were most susceptible to paraffin injury, a canker resulting in the death of maiden trees was traced to the use of mineral oil for the control of the aphis. The shoots of a number of apple varieties were found to be injured or killed by the action of paraffin, the effect of which was observable usually a little below the point of application, occasionally about a fortnight after application, but sometimes not till several months had elapsed. Wood of the current or previous year was most severely injured, but branches up to 5 years old were also killed in some instances by a single treatment. In literature on woolly aphis and "canker" in the British Isles the association of "canker" with injuries caused by the insect is often noticed and is generally attributed directly to *Nectria galligena*. Experimental results recorded here indicate the possibility of at least some of these cankers being due to paraffin injury. Petrol was also found to have ill effects, but methylated spirit even after a second and third application proved harmless.

The following also are noted :—

WORMALD, H. **Brown rot fungi—recent observations on their incidence.** *East Malling Res. Sta. Ann. Rept. for 1933*, **A.17**, 1934, pp. 250-5 (reprinted from *Fruitgrower*, August 17th and 24th, 1933).

VERESCEAGHIN, B. Les ennemis de la vigne at les moyens de les combattre. (**The enemies of the vine and control measures.**) *Rev. Viticulture*, 1934, **80** : 37-44, 60-3. [Based on observations made at the phytopathological station of Kichinau in Rumania.]

MASSEE, A. M. **The warm water treatment of strawberry plants.** *East Malling Res. Sta. Ann. Rept. for 1933*, **A.17**, 1934, pp. 256-7.

PAPE, H. Neue Wirtspflanzen der Blattälchen *Aphelenchus ritzemabosi* Schwartz u. *Aphelenchus olesistus* Ritz. Bos. (**New host plants flowers and shrubs—ED. of *A. ritzemabosi* and *A. olesistus*.**) *Gartenbauwiss.*, 1934, **8** : 477-87, bibl. 25.

AUSTIN, M. D., AND OTHERS. **Studies on the ovicidal action of winter washes —1933 trials.** *J. S. E. agric. Coll., Wye*, 1934, **34** : 114-35, bibl. 6.

N.Z. HORTICULTURE DIVISION. **Control of orchard disease by spraying.** *N. Z. J. Agric.*, 1934, **48** : 209-17. (Formulae and times of application in New Zealand of the principal orchard sprays are given as a guide to orchardists.)

CUNNINGHAM, G. H. **Orchard Sprays in New Zealand : VI. The nicotine series, and VII. Combination sprays.** *N. Z. J. Agric.*, 1933, **47** : 154-60, bibl. 20 and *Ibidem*, 1934, **48** : 1-12, bibl. 31.

FLEMING, W. E. **Development of a standard cage method for testing the effectiveness of stomach-poison insecticides on the Japanese beetle.** *J. agric. Res.*, 1934, **48** : 115-30, bibl. 13.

GREENSLADE, R. M., AND MASSEE, A. M. **Some notes on the woolly aphis parasite (*Aphelinus mali* Hald.).** *East Malling Res. Sta. Ann. Rept. for 1933*, **A.17**, 1934, pp. 225-7, bibl. 3.

HEY, G. L., AND MASSEE, A. M. ***Tortrix* investigations in 1933.** *East Malling Res. Sta. Ann. Rept. for 1933*, **A.17**, 1934, pp. 228-30.

HOUGH, W. S. **Colorado and Virginia strains of codling moth in relation to their ability to enter sprayed and unsprayed apples.** *J. agric. Res.*, 1934, **48** : 533-53. bibl. 13.

GILLIATT, F. C. **Notes on the lesser bud moth, *Recurvaria nanella* Hbn.** *Sci. Agric.*, 1934, **14** : 466-76.

VEGETABLE GROWING.*

399. DARBYSHIRE, F. V.,† AND TINCKER, M. A. H. 635.1/7-1.4

Soil experiments at Wisley. The influence of soil factors upon the growth of certain vegetables.

J. roy. hort. Soc., 1934, **59** : 251-73, bibl. 11, being *Contribution from the Wisley Laboratory, LXXII.*

In 1928 4 soils were collected at Wisley, namely, (1) a London clay, (2) a loam, (3) a chalky soil and (4) a sandy soil. Twenty-four pits, each 20 feet by 10 feet by 3 feet were made and lined with bricks laid in cement mortar. The pits were filled with the different soils and were found to contain each about 20 tons of soil. The following crops were grown in them :—turnips, radishes, peas, spinach and lettuce, and observations were made on their growth. As regard the clay soil germination and subsequent development were satisfactory and a high percentage overwintered successfully. [Actually the so-called London clay was found to have a high proportion of sand and fine sand.—ED.] Germination and establishment were poor in the loam, though the plants produced were large. Overwintering was low even after killing off the wireworms. In the chalk all seeds germinated well, but the seedlings only grew slowly. Overwintering was satisfactory except in the case of one lot of lettuce plants. In the sand germination was generally rapid, but after a severe frost only few of the seedlings or of the larger plants remained alive. Mechanical and chemical analyses were made at different times and the analyses are tabulated.

400. OGILVIE, L., AND MULLIGAN, O. 635.1/7-2.3/4

Progress report on vegetable diseases. V.

Long Ashton Res. Sta. Ann. Rept. for 1933, 1934, pp. 98-120.

Work on the following diseases is here discussed :—of asparagus : rust (*Puccinia Asparagi*), violet rootrot (*Rhizoctonia Crocorum*) and *Zopfia rhizophila* ; of dwarf beans : halo blight (*Bact. Medicaginis* var. *phaseolicola*) and footrot (*Fusarium solani* var. *martii*) ; of runner beans : halo blight and wilt (*Fusarium* sp.) ; of *Brassicae* : finger and toe (*Plasmodiophora brassicae*) ; of leaks : white tip (*Phytophthora Porri*) ; of lettuce : ring spot (*Marssonina panattoniana*), *Botrytis* disease, mosaic ; of mint : *Puccinia Menthae* ; of onion : white rot and smut ; of parsnip : *Ascochyta* sp. ; of peas : footrot (*Heterodera* sp.) ; of marrow : mosaic.

401. HORSFALL, J. G., AND OTHERS. 631.531.17

Dusting miscellaneous seeds with red copper oxide to combat damping-off.

Bull. N. Y. St. agric. Exp. Sta., **643**, 1934, pp. 39, bibl. 8.

The chemical is found to be partly effective against *Rhizoctonia Solani*, though its main effect is on *Pythium ultimum*. It is suggested that for seeds the size of spinach or smaller and for rough, light seeds such as beet a proper dose would be 2½ lb. dust to 100 lb. seed. For larger or heavier

* See also 496.

† The late.

seeds such as peas or cucumber ½ to ¼ lb. per 100 lb. is recommended. The dust should be intimately mixed with the seed. Under dry conditions treated seed has not suffered in germination or effectiveness of the chemical by storage for 10 months. Lists of vegetable and flower seeds successfully treated and of those which were injured by the process are given.

402. ODLAND, T. E., AND CRANDALL, F. K. 635.34-1.8
Response of early cabbage to manures and fertilizers.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 470-4, bibl. 3.
Sixteen tons of farmyard manure supplemented by complete chemical fertilizer produced larger and more economical yields than 32 tons of manure alone. Green manure plus 8 tons farmyard manure increased yields 10% over that following green manures plus chemicals. Two crops of vegetables, cabbages and beet, were grown in a season in the stable manure rotation as against cabbages alone when green manuring was adopted. It should, however, be noted that under Rhode Island conditions satisfactory crops of early cabbage can be grown with little or no additional manure.

403. LARSON, R. H., AND WALKER, J. C. 635.34-2.42
Soil treatment in relation to club root of cabbage.
J. agric. Res., 1934, **48** : 749-59, bibl. 6.
Field treatments of 2 silty clay loam soils with calcium hydrate and calcium magnesium carbonate raised the soil reaction to pH 7·1 and above but did not generally inhibit clubroot development. In treated soils, however, which were removed to the greenhouse cabbage plants remained free from infection. This inhibition of infection occurred in treated soil at high, intermediate and low, relatively constant, moisture levels. The results of the field trials over a three year period indicated that seasonal and soil factors greatly influence the action of liming materials as inhibitors of clubroot.

404. SHUCK, A. L. 635.52-1.521.5
Some factors influencing the germination of lettuce seed in seed laboratory practice.
Tech. Bull. N. Y. St. agric. Exp. Sta., **222**, 1934, pp. 21, bibl. 7.
Studies were made of the effect of light, moisture and temperature, both singly and in combination on the complete germination of lettuce seed of various ages. It was found that for several months after harvest germination of the seed in the seed testing laboratory is promoted by exposure to light, by the use of a very moist substratum and by starting germination at a low temperature. The following are recommended :—moist blotters exposed to ordinary light, and a temperature of from 15° to 20° C. (59° to 68° F.).

405. COCHRAN, H. L. 635.56
Abnormalities in the flower and fruit of *Capsicum frutescens*.
J. agric. Res., 1934, **48** : 737-48, bibl. 17.
The author reviews the literature of the last 50 years and presents a detailed study on the abnormalities occurring in the flower and fruit of the pepper.

406. WESTOVER, K. C., AND MCCUBBIN, E. N. 631.589 : 635.56 +635.646
The influence of soil type on results from paper mulch trials with the pepper and eggplant.
Gartenbauwiss., 1934, **8** : 573-80, bibl. 4.
Experiments on a silty clay loam at Morgantown and in a Wheeling fine sandy loam in the lower Ohio valley strongly suggest that as in the case of the tomato, discussed by the authors elsewhere, mulch paper may be less profitable for eggplant and pepper on light soils than on heavy soils. Soil temperature was found to be an important factor, the mulch increasing the soil temperature on the heavy soil and therefore doubtless considerably influencing the early development of the plants.

407. BOLAS, B. D. 635.64 : 551.56 : 581.13
The influence of light and temperature on the assimilation rate of seedling tomato plants, variety E.S.1.
Exp. and Res. Sta., Cheshunt, Ann. Rept. for 1933 (19th year), 1934, pp. 84-7.
The work was confined to seedling plants 5 inches high. It is made clear that for any particular light intensity there is one temperature only at which the assimilatory mechanism of the plant is working most efficiently. Conversely each degree of light intensity is most efficient at one particular temperature. A graph, based on experimental evidence to date, shows the approximate relation of the optimum temperature for assimilation to light intensity.

408. MELVILLE, R. 635.64 : 581.13
Water-content and assimilation of seedling tomato plants.
Exp. and Res. Sta., Cheshunt, Ann. Rept. for 1933 (19th year), 1934, pp. 87-92.
The results are reported of two parallel series of assimilation experiments made during 1933. Determinations were made of the gain in dry weight during a seven hour assimilation period of seedling plants of E.S.1 grown under normal conditions in a glasshouse and of plants grown similarly except that they were placed in darkness six hours before sunset on the day preceding the experiment and uncovered at midnight. Thus in both series the length of the period of darkness preceding the experiments varied at different times of the year. The author summarizes as follows :—(1) The water content of tomato plants of the same age and history varies little from plant to plant. (2) There is a seasonal drift of water-content from the summer value to a higher value in the winter. The uniformity of the drift is broken by the effect of stopping, and of restarting the glasshouse heating system. (3) The assimilation rate increases with rising water-content until an optimal value is reached, after which assimilation falls rapidly with a further rise in water-content. (4) There is evidence that water-content may become supra-optimal in winter.

409. THOMPSON, H. C. 635.64-1.542
Pruning and training tomatoes.
Bull. Cornell agric. Exp. Sta., **580**, 1934, pp. 14, bibl. 11.
The tomato used in these trials in New York State was Bonny Best. Plants were pruned to a single stem and each plant was tied to a stake. Five to six prunings were generally necessary at intervals of about a week. The main advantage over unpruned plants was an increase in early crop, there being a considerable difference in quantity of fruit produced to the acre in the first 15 to 19 days of cropping. Size of individual fruits was on the average slightly larger on the pruned plants. The cost of labour was considerable and to get the same yield as from unpruned plants it was necessary to plant much more closely together. Decision as to the advisability of pruning would appear to depend on whether the returns from the early yield more than compensate for additional labour costs.

410. YARNELL, S. H. 635.64-2.11
Influence of heredity with respect to a fruit defect of the tomato.
Gartenbauwiss., 1934, **8** : 616-33, bibl. 11.
The condition which is known as " tomato puff ", is of two forms. In the more common form the placental tissue fails to develop properly, leaving the fruit partially hollow, in the other form there is very little placental development, and the locular walls have proliferated and grown hard so as to be unpalatable. Observations were made of differing incidence between and within varieties and strains under different environmental conditions. A ready response was found to environmental conditions. Indications are forthcoming from the experimental data that (a) varieties, (b) certain strains of the older varieties and (c) a number of individuals within such strains differ genetically with respect to factors affecting the amount of puffing. It is suggested that individual plant selection would quickly reduce puffing among the older varieties and that varietal crossing with subsequent recombination of factors might be expected to effect a further reduction.

411. CHAMBERLAIN, E. E. 635.64-2.8
Tomato-mosaic.
N. Z. J. Agric., 1934, **48** : 344-51, bibl. 16.
The appearance, cause, and preventive treatment of tomato mosaic both in the field and under glass are described. Preventive measures suggested are :—Use seed only from mosaic-free sources ; destroy all infected seedlings before planting out ; if the disease appears, handle plants as little as possible ; work with healthy plants before touching the diseased ones ; thoroughly wash the hands in running water after touching infected plants ; burn all plants of an infected crop including the roots as soon as possible after the season is at an end.

412. TALBOT, P., AND TAVERNETTI, A. A. 635.656
Growing and handling market peas in California.
Circ. Calif. agric. Ext. Serv., **85**, 1934, pp. 36.
Peas will grow on a variety of soil types, but drainage is essential. Clay and silt loams are found to produce higher yields than lighter soils because they are cool, retentive of moisture and usually more fertile. Cultural methods are discussed including irrigation. Notes are given on yield, grading and packing, as well as on marketing. The containers used for transport are the 1 bushel hamper, the 1 bushel box and the 2 bushel crate. After lidding the pack is loaded into refrigerator cars. Varieties are discussed and the principal diseases and pests mentioned, remedies being suggested in some cases.

413. WALTON, C. L., AND OTHERS. 635.656-2.651.3
Observations on the pea strain of the eelworm, *Heterodera schachtii*, and its relation to " pea sickness ".
Long Ashton Res. Sta. Ann. Rept. for 1933, 1934, pp. 74-85, bibl. 9.
Trials were made first in the greenhouse at Long Ashton and later in the field to determine if possible the physiology of this race of eelworm, on its range of hosts and on its relationship with footrots. Field trials took place in North Somerset and in the Evesham area. A list is given of economic plants and weeds which, being during the trials accidentally or designedly associated with the infested crop, proved not to be susceptible. The pea strain of *Heterodera* was found also to infest broad beans, vetches, and red clover, but not potatoes, mangolds, sugar beet, kale, cabbage, sweet peas, oats or any of 23 named weeds. The trouble occurred almost equally on heavy and light soils and in wet and dry seasons. It is suggested that long rotations free from susceptible leguminous plants may afford control. It is noted, however, that a rotation which included 3 years free from beans or peas was insufficient to free the soil from infection.

414. WARE, W. M. 635.8
Mushrooms.
J. roy. hort. Soc., 1934, **59** : 230-5.
The author gives a general account of the methods advisable and touches on certain features of special importance and interest. He notes that a survey of the whole subject has already been published in *Bulletin* 34, 2nd edition, of the Ministry of Agriculture, London. [For fuller information this bulletin by the same author is recommended.—ED.]

415. JARY, S. G., AND AUSTIN, M. D. 635.8-2.6/7
Insect and allied pests of cultivated mushrooms. I. The incidence of attacks and their relation to growing practice, by Jary, **and II. Laboratory investigations,** by Austin. Being papers presented at the meeting of the Association of Applied Biologists, held in London on October 20th, 1933.
Ann. appl. Biol., 1934, **21** : 162-71.
Jary first outlines the process of building up a mushroom bed from the manure compost and then proceeds to discuss mushroom pests which he first divides for convenience sake into 3 categories, namely (1) those associated with certain types of buildings and situation, (2) those associated

with the manure or soil used, and (3) those specific to mushrooms. Under (1) are grouped a number of animals of omnivorous habit such as woodlice, slugs and millipedes, which are liable to eat holes in the caps. Mice and rats occasionally eat mushrooms and do damage both by boring into the beds and by the introduction of fungous diseases brought from outside. (2) The natural fauna of the manure used will probably vary with the conditions under which it is kept and with the treatment accorded to it. Mites of various species are commonly found as also dipterous larvae, especially those belonging to the *Phoridae*. Mite injury consists mainly of shallow, irregular holes eaten in the caps and stalks. Springtails also cause small lesions on the stalks and edges of the caps but the damage is seldom severe. During the formation of the manure bed from the compost the temperature developed in the centre may rise to 160° F. and, although this is dispersed at the frequent turnings which take place, it probably has considerable sterilizing effect on the fauna present. Attempts are now being made to use steam and insecticidal substances to treat the compost at various stages in order to rid it of such pests. (3) These are the so-called " mushroom flies " belonging to the genus *Sciara* of the *Mycetophilidae*. II. Austin describes the laboratory technique which he has used in rearing *Sciara* flies. In the first method miniature mushroom beds are prepared in boxes about 24 in. by 18 in. by 6 in., compost and spawn are introduced as required, and temperature is kept equable by rough and ready methods of damp moss and sacking. Flies are then introduced. This method was found to present several disadvantages and a second method was tried. Glass jars half filled with compost were steamed and after sufficient cooling flies, larvae or eggs were introduced and the tops of the jars sealed with cellophane. One important fact was discovered during the use of this method, namely that *Sciara* larvae can live entirely in a medium of compost in the absence of growing mushrooms. This method was found preferable to the first but is not considered ideal. The life history of *Sciara* flies is detailed and it is noted that two, three or more generations may occur during the " life " of a mushroom bed, which makes it imperative that these pests should be controlled at an early stage. In all probability such flies are active vectors of mites and diseases. The biology of species of the *Phoridae* is now being investigated. Other flies noted as inviting further investigations are *Cecidomyiidae* sp., *Drosophila funebris*, *Limosina ferruginata*. Pyrethrum, nicotine and derris dusts and sprays have been used in the control of mushroom flies and the author is inclined to advocate the use of a nicotine spray. One of the difficulties is the possibility of staining the caps of the mushrooms. The preliminary nature of the above work on pests is noted and the authors suggest that to study efficiently the interrelation of the important factors of temperature and humidity and insect pests a special building is essential.

416. AUSTIN, M. D., AND JARY, S. G. 635.8-2.6/7
Investigations on the insect and allied pests of cultivated mushrooms. II. and III.*
J. S. E. agric. Coll., Wye, 1934, **34** : 70-86, bibl. 9.

In the first paper the authors deal with the incidence and method of attack adopted by the following pests :—Species of *Diptera*, especially *Sciara* sp., *Aphiochaeta* sp., *Mycophila* sp., *Collembola*, in particular *Hypogastrura armata* ; *Acarina*, including *Caloglyphus kramerii* ; *Nematoda*, including *Rhabditis* sp. Their connection with various fungus or bacterial diseases of the mushroom is also noted. In the second paper a description is given of the natural fauna of stable manure used in the preparation of mushroom beds in the neighbourhood of Wye. It is interesting to note that among the considerable number of insects and mites found there is a notable absence of the known pests of mushrooms. This may be due to the time of sampling or to other reasons which are discussed.

The following also are noted :—

NIGHTINGALE, G. T. **Effects of temperature on metabolism in tomato.** *Bot. Gaz.*, 1933, **95** : 35-58, bibl. 36.

BEWLEY, W. F. **Lettuce as autumn and winter crop in glasshouses.** *Fruit-grower*, 1934, **97** : 2001 : 697-8, 706.

* See *Ibidem*, 1933, 32 : 59, *H.A.*, 1933, 3 : 3 : 361.

CLARK, H. E., AND SHIVE, J. W. **The influence of the pH of a culture solution on the rates of absorption of ammonium and nitrate nitrogen by the tomato plant.** *Soil Sci.*, 1934, **37** : 203-25, bibl. 45.
and,
CLARK, H. E., AND SHIVE, J. W. **The influence of the pH of a culture solution on the assimilation of ammonium and nitrate nitrogen by the tomato plant.** *Soil Sci.*, 1934, **37** : 459-76, bibl. 24.
HOGGAN, I. A. **Some factors involved in aphid transmission of the cucumber-mosaic virus to tobacco.** *J. agric. Res.*, 1933, **47** : 689-704, bibl. 21.

FLOWER GROWING.

417. POST, K. 635.939.98 : 612.014.44
Production of early blooms of chrysanthemums by the use of black cloth to reduce the length of day.
Bull. Cornell agric. Exp. Sta., **594**, 1934, pp. 30, bibl. 16.
The results are given of 4 years' work with the use of black cloth for reducing the length of day on chrysanthemums, a " short day " plant, for the production of early blooms. Both large flowered and pompon varieties were used. Treatment, which started in the greenhouse in July when the normal day was some 15 hours, consisted of cutting off the plants completely from light by excluding the daylight for periods which resulted in the length of day being limited to 9, 11 and 13 hours. This was achieved by pulling over the plants black sateen cloth having 68 by 104 threads to the square inch mounted on a wooden frame and adjustable by means of wires to the required positions. By reducing to 11 hours both types were brought into bloom as much as 70 days before their normal season. Such blooms had shorter stems than blooms produced ordinarily. Notes are made of the effect on growth, size etc. and on colour. Thus pink and bronze varieties were lighter in colour when forced to bloom early. Details are given of results of variations in treatment such as alternating ordinary length of day with shortened days.

418. PRIDHAM, A. M. S. 635.939.43
History, culture and varieties of summer flowering phloxes.
Bull. Cornell agric. Exp. Sta., **588**, 1934, pp. 32, bibl. 71.
This small but comprehensive treatise should be of great interest to those interested in the many varieties of this popular flower. It was originally introduced into England from North America, of which all species except *P. sibirica* are stated by the author to be native.

419. RUSSELL, P. 635.976.32
The oriental flowering cherries.
Circ. U.S. Dep. Agric., **313**, 1934, pp. 72, bibl. 18.
A description, botanical and horticultural, of some 8 species of flowering cherry including 50 odd horticultural varieties. Historical notes are followed by cultural suggestions, a discussion of propagation methods, hardiness, forcing, insect pests and diseases. As regards propagation difficulty is experienced in raising from cuttings. Nearly all propagation in the States is done by budding or grafting on seedling stocks. The time of budding varies with weather, locality and individual preference. Grafting is perhaps even more common, the usual procedure being to bench graft on piece roots of Mazzard or Japanese cherry. A rootstock test is now in progress at the Arlington experiment farm, Washington D.C. Three kinds of stock, Mazzard and two types of Japanese seedling, the Yama-zakura (*Prunus Sargentii* Rehder) and the Oshima-zakura (*P. Lannesiana f. albida*) were budded some 8 years ago with various flowering cherries, but as yet there is no significant difference in the appearance of the three groups. The insects and pests are those common to other rosaceous woody plants.

420. DECKER, S. W. 631.535 : 631.432
Moisture in relation to the rooting of cuttings.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 596-7.
Equipment consisted of pans in which the propagating medium was placed. A water table was established in this medium and kept at a constant level by means of two lines taken from a sealed reservoir above the propagating bed. The height of the medium above the water table determined the amount of water contained. A clean sharp river sand of medium grade, pH about 8·5, was used. The watering was never done from above. Material used included cuttings of carnations, centaurea, coleus, geranium, lantana, sedum, snapdragon, chrysanthemum, achyranthus, santoliance. In nearly every case* maximum rooting was obtained where the moisture expressed as a percentage of dry weight of sand was 19-21. Percentage rooting decreased with decreasing moisture.

421. WESTCOTT, C. 635.937.34-2.48
Brand canker of rose caused by *Coniothyrium Wernsdorffiae* Laubert.
Mem. Cornell agric. Exp. Sta., **153**, 1934, pp. 39, bibl. 67.
The symptoms of this canker and of stem canker, *C. Fuckelii*, are presented and differentiated. No control has been obtained at Ithaca, N. York, by spraying or dusting in the growing season or by lime sulphur as a dormant spray in late autumn. The removal of diseased canes helps to eradicate the fungus but must be done very thoroughly to be effective. It was almost entirely controlled by leaving the roses uncovered during the winter.

422. READ, W. H., AND ORCHARD, O. B. 631.544 : 632.944 ; 632.184
Plant injury following the burning of sulphur in glasshouses.
Exp. and Res. Sta., Cheshunt, Ann. Rept. for 1933 (19th year), 1934, pp. 98-100.
The fumigation with burning sulphur of glasshouses painted with paints containing zinc oxide has caused considerable damage to chrysanthemums through drippings from the painted structure or from galvanized wire carrying zinc sulphate in solution on to the foliage and buds. When sulphur is used for dusting purposes there is not sufficient zinc sulphate formed to cause damage. There is no damage caused by drip when lead paint is used. Remedies are :—To hose down the house at frequent intervals, this being most effective when condensed moisture in the interior of the house has already taken into solution part of the zinc sulphate. Failing the practicability of hosing the only remedy is to prevent drip by maintaining a dry atmosphere. If galvanized wires are involved they can be lowered. To avoid risk naphthalene or formaldehyde should be used as a substitute fumigant, more especially as the formation of soluble zinc sulphates must cause a partial destruction of the paint, or a paint containing a lead or barium base can be used.

423. KEARNS, H. G. H., AND WALTON, C. L. 632.651.3 : 635.939.98
Experiments on the control of the chrysanthemum eelworm (*Aphelenchoides ritzema-bosi* Schwartz). Seasons 1931-33.
Long Ashton Res. Sta. Ann. Rept. for 1933, 1934, pp. 66-73, bibl. 5.
The authors make the following recommendations. 1. The preliminary experiments indicate that a satisfactory control of eelworm may be obtained by immersing infested stools in hot water maintained at 110° F. for twenty minutes. Temperatures in excess of 115° F. should be avoided as they retard the production of basal shoots. 2. The stools required for propagation should be treated some weeks before the normal time of taking cuttings, as the hot water treatment temporarily delays the growth of the basal shoots. 3. It is essential that the treated stools and resultant cuttings be grown in soil free from eelworm and care must be taken to ensure that any pots or boxes used are also free from the pest.

* Santoliance and *Sedum sarmentosum* proved exceptions, maximum rooting being obtained at a 6-7% moisture content.

424. ABBISS, H. W. 635.944-1.531.17
Safeguarding our bulb industry. Sterilization and dusting.*
Fruitgrower, 1934, **97** : 429-30 and **97** : 611-12.

The author discusses the question of the sterilization of bulbs and the problems connected therewith, such as the optimum period of dipping and the requisite pre- and post-sterilizing treatment. Seasonal conditions vary and the best treating time one year may be wrong the next. After treatment the bulbs should be cooled gradually and dried under cover in containers such as wire-meshed bottom trays. Exposure of treated bulbs to cold rains and sun causes damage. Sterilizing is essential not only against eelworm but also for the control of the narcissus fly and bulb mites which cause blindness, but there is a danger of spreading fungous diseases from bulb to bulb through the treating water. The author recommends the use of such fungicides as Steriform and Uspulun at concentrations of 0·5% and 0·125% respectively in the water. Bulb dipping is also being tested against such diseases as basal rot of daffodils (*Fusarium*), tulip fire (*Botrytis Tulipae*), daffodil fire (*Ramularia* sp.) and iris foliage troubles. Against daffodil fire dusting has also been tried with varying success. Notes are given of results, as also of the salutary effect on tulip fire of deep planting at 10 in. and 12 in. compared with control bulbs at 8 in.

The following also are noted :—

HOSER, P. Heterosis bei einem Pfropfbastard von *Syringa vulgaris*. (**Heterosis in a graft hybrid of *S. vulgaris*).** *Gartenbauwiss.*, 1933, **8** : 451-4.

BATSON, F. S. **Influence of media and maturity of wood on the vegetative propagation of *Camellia japonica*.** *Proc. Amer. Soc. hort. Sci.*, 1933, **30** : 598-601.

DURHAM, G. B. **Propagation of evergreens under different temperatures at different times of the year.** *Proc. Amer. Soc. hort. Sci.*, 1933, **30** : 602-6.

LOOMIS, W. E. **Forcing gladiolus.** *Proc. Amer. Soc. hort. Sci.*, 1933, **30** : 585-8, bibl. 6.

WHITE, H. E. **Preliminary report on breeding rust resistant snapdragons.** *Proc. Amer. Soc. hort. Sci.*, 1933, **30** : 589-90, bibl. 4.

TAUBENHAUS, J. J., AND EZEKIEL, W. N. **Fusarium wilt and corm rot of freesias.** *Bot. Gaz.*, 1933, **95** : 128-42.

GANTE, T., AND ZIMMER, R. Einige Beizversuche mit Gemüse—u. Zierpflanzensämereien. (**Pickling trials with the seed of certain vegetable and ornamental plants.**) *Gartenbauwiss.*, 1934, **8** : 609-15, bibl. 11.

CITRUS AND SUB-TROPICAL FRUITS.

425. MARSHALL, G. W. 634.3
Citrus fruit growing in Rhodesia.
Bull. Minist. Agric. Southern Rhodesia, **920**, 1934, pp. 58, reprinted from *Rhod. agric. J.*

This is a practical guide for anyone intending to grow citrus in the country, the whole process of growing the fruit from seed or bud to ripe fruit being detailed. Harvesting, packing and marketing are not dealt with. Among recommendations made are the following. Valencia Late is recommended as being the best standard orange for export from Rhodesia. The common rough lemon is recommended as a stock. Stocks should be budded at least 9 inches above the ground, using the inverted " T " bud method. Artificial shelter should be provided. Deep well-drained sandy soils are best for producing high quality fruit. Groves should be laid out on the contours using the square system of planting. Provision must be made for irrigation. Leguminous cover crops should be planted at the beginning of each rainy season and ploughed in when they

* See also *H.A.*, 1934, 4 : 1 : 97 and 98.

have attained their maximum growth. The grove should be well ploughed towards the end of the rainy season and then cultivated frequently to eradicate weeds and prevent unnecessary evaporation of soil moisture.

426. MARTYN, E. B. 634.3
Citrus cultivation in British Guiana.
Agric. J. Brit. Guiana, 1934, **5** : 22-31.

The work of the Department of Agriculture of British Guiana in dealing with the difficulties of citrus cultivation in that colony is described. [When the cultivation methods follow normal and familiar lines they are omitted from this abstract.—ED.] Citrus is grown with varying degrees of success on the lighter soils of the Colony, but the best local seedling varieties, although considered superior as dessert fruit to the standard varieties, were too uneven in appearance and flavour to fill the requirements of northern markets. Budwood and budded plants of a number of standard varieties were accordingly imported from Trinidad and Florida. The heavy clay soil of the Botanic Garden where one rootstock nursery was situated was unsuitable for the proper growth of the plants. The stock here would develop one main taproot which was pushed well down into the clay and had very few laterals. In consequence the young trees suffered severely when lifted from the severance of what was practically their only root, further they were apt to wilt when the taproot reached the waterlogged sub-soil and developed bench root owing to the difficulty experienced by the radicle of the seedling in penetrating the stiff soil. This soil was successfully improved by the following methods. The beds were built up with soil mixed with burnt earth, dust or with a light gravelly soil brought from another locality, deep drains were dug between the beds, and a system of bamboo drains was established under each bed. This latter measure resulted in the formation of a considerably better distributed root system. The budded plants when lifted for distribution are packed each with a ball of soil attached which is encased in a round basket made from the split stems of *Ischnosiphon* spp., this precaution being rendered necessary by delays both in transit and in planting after delivery. The buds are inserted at a height of 1½ to 2 ft. on the stock. About 60% of the seedlings eventually make good plants. This is considered fairly satisfactory under the prevailing conditions and with imported budwood. Only a few years ago the budding of oranges in British Guiana achieved such small success that it was given up as impracticable.

427. PARKER, E. R., AND BATCHELOR, L. D. 634.31 : 581.084.2
Variations in the yields of fruit trees in relation to the planning of future experiments.
Hilgardia, 1932, **7** : 2 : 81-161, bibl. 70.

The variability in the yields of experimental plants, caused by factors other than those due to the treatments under trial, is of great importance in the planning of the experimental field and in the interpretation of the results. This paper deals with a trial on Washington Navel oranges which was treated uniformly until seven crops had been harvested, after which the differential treatments were put into effect. The records taken of the size and cropping of the trees for the seven year period were analysed for variability, which was relatively low for all years except the first, and it was apparent that the use of yield data for the first year of production would not have led to results which would have been duplicated in succeeding years, if the orchard had been under differential treatment at the time. These yields were therefore omitted from the studies, and the data obtained over the six year period was used in calculations to determine the effect of various plans upon variability of test plots and the magnitudes of the differences required to give significant results. The use of check plots to reduce variability due to soil difference is discussed, checks being located at various intervals and the adjusted yields of the test plots being used in the calculations. As a result of these studies a plan for the experimental orchard was adapted to the practical ends desired. Finally, correlations between tree-sizes and yields are calculated, and the tree-size relations of the experimental plots as planned on the basis of yields are given. These size means of the individual treatments approximate to the mean of the orchard with very few exceptions, in which cases some adjustment might be desirable. J.L.E.

428. West, E. S. 581.144.2 : 634.3

The root distribution of some agricultural plants.

J. Coun. sci. industr. Res. Aust., 1934, **7** : 87-93, bibl. 2.

The root zones of lucerne, wheat, beans, rice and citrus (not growing on identical soils) were examined. The method of securing material consisted of boring by means of a Veihmeyer soil tube (which removes a core of soil of 1 inch in diameter) in depth increments of 10 cm., avoiding, however, the inclusion of two soil horizons in one increment. The absorbing roots containing the core thus removed were washed out, dried and weighed. It is claimed that by this method a determination of the extreme limit of the root zone can be readily made, and also a numerical factor can be obtained to indicate the relative root concentration in successive layers of soil. While the absorbing power of equal weights of roots must differ between the species, the figures obtained at least show the relative concentration of the absorbing roots with depth for any particular plant. With the exception of citrus (which was on rough lemon stock) all the root systems examined showed great concentration very close to the surface, actually in the upper 10 cm. In the case of citrus the greatest concentration was at 30-50 cm., the reason for the deeper concentration being ascribed to the disturbance of surface roots by cultivation. It is argued that the tendency of nearly all plants in uncultivated ground to develop their greatest root concentration close to the surface must be due to some benefit thus received by the plant. For this reason deep cultivation or in fact any cultivation other than that necessary to control weeds is better avoided. Diffusion of roots is the chief agent of aeration and if this diffusion is checked by cultivation it is difficult to see how cultivation can beneficially affect the aeration of the root zone.

429. Halma, F. F. 634.3-1.541.11

Scion influence in citrus.

J. Pomol., 1934, **12** : 99-104, bibl. 7.

Eureka lemon scions grafted on to twigs or root pieces of sour orange changed the inherent taprooted form of the sour orange, the root system remaining lateral ; it also modified the colour reaction of the root bark extract according to the test evolved by Halma and Haas. Bark extract of the roots proper of the sour orange stock, developed after grafting, gave a colour reaction which was neither that ordinarily given by the lemon nor that given by the sour orange, but was much closer to the former. The external colour of the freshly dug roots was also affected. Sour orange on the other hand when grafted on to Eureka lemon stock caused only one such change, namely in the external colour of the roots. It is supposed that the method of propagation is a factor, since these scion effects have not been observed in budded trees.

430. Webber, H. J. 634.337-1.541.11

Comparative yield and tree size of lemons on various rootstocks.

Calif. Citrogr., 1934, **19** : 233, 257.

A short account is given of citrus rootstock trials begun in 1927 at the Riverside Experiment Station. A number of stock strains are being tested with the principal citrus fruits—Eureka and Lisbon lemons, Washington Navel and Valencia oranges, Marsh grapefruit, Satsuma mandarin. All bud propagations were made from a single tree of each variety. The stocks also were raised from seed of a single tree of each variety used and were carefully rogued of variants until it could be reasonably assumed that the remaining seedlings were of apogamic origin. The layout consisted of two or three replications of 5 tree plots of each variety in two radically different localities. As the trees are only in their third crop year no conclusion can be reached, but a summary of the data already available for Eureka and Lisbon lemon is given. Taken as a whole sweet orange stocks stand at the head of the list for yield, followed by rough lemon, and this result is in accordance with the general observation that the old lemon groves to be found locally on sweet orange are the equals or superiors of groves of similar age on other stocks. Rough lemon has given results in the trials so far which entitle it to special consideration, but it lacks the backing of a consensus of favourable field experience such as is accorded to the sweet orange, and until more evidence is available its employment should be experimental only.

431. Vinik, M. 634.3-1.8-1.67
The scientific supervision on the manuring and irrigation of citrus trees.
Hadar, 1934, **7** : 107-11.

This article describes in general terms the work on problems connected with manuring and irrigation of citrus carried out in the past or still in progress at the Mikveh-Israel Agricultural School, Palestine. The present plant of 10 lysimeters is being increased by a further 45, which will allow of the continuation of experiments in more detail than has been hitherto possible.

432. Oppenheimer, H. R., and Mendel, K. 634.3-1.67
Some experiments on water relations of citrus trees.
Hadar, 1934, **7** : 35-7, 59-60, 150-5, bibl. 20.

The preliminary results are discussed of experiments at the Research Station, Rehovoth, Palestine, undertaken to determine to what limit the water supply may be diminished to citrus trees without interfering with their principal processes of nourishment. On a normal autumn day the water saturation deficit (w.s.d.) (i.e. the degree of saturation expressed as a percentage of full saturation at which point the w.s.d. is 0) in a grove of budded Jaffas was as follows :—At 9 a.m. temperature 20° C., relative humidity 69%, w.s.d. was 6·8%. At 2.30 p.m. with temperature 20° C., relative humidity 72%, it rose to 7·7% and fell at 8 p.m., when there was a thick fog with relative humidity 100%, temperature 16° C., to 4·4%. On a dry day, following a drying wind which had lasted two weeks the saturation deficit at noon was 13·3%. A hedge of sour orange which had not been irrigated the whole summer contained parched bushes which had shed many leaves, those which remained being of a yellowish green colour owing to the partial destruction of the chlorophyll bodies by protein decomposition in the excessive respiration processes. Here the w.s.d. was from 49·5% to 60·2%. In wilting but still green trees in the same hedge it was between 37·6% and 45·4%. This well illustrates the high degree of drought resistance of the sour orange especially when compared with the saturation deficits of plants from other regions as found by Stocker (*Jahrb. wissensch. Bot.*, 1933, 78 : 751-856), i.e. a maximum of 13% for the Baltic coast, 23% for heather, 27-40% for the plants of the South Russian steppes. Only plants from the Egyptian desert with a w.s.d. of 37-56% were at all comparable with *Citrus Bigaradia*. Oppenheimer's submortal water saturation deficit, i.e. that which causes the death of more than 5% and less than 10% of the leaf, was determined for *C. Bigaradia* to be between 51% and 60% (in one case 72·6%) and for sweet lime 54·8% and 57·8%. One sweet lime leaf which had lost 66·6% of its saturation water content became completely refreshed on transference to a moist chamber. The Jaffa orange was found to be less resistant to drought than either sour orange or sweet lime, the submortal w.s.d. being between 40% and 50%. The symptoms of damage from water differ in the Jaffa and sour orange. In the latter after injurious wilting the areas near the margin where the water supply is comparatively poor become brown with a well marked boundary between the dead and healthy tissues, the latter remaining turgid. In the Jaffa and probably in other sweet oranges there is no marked boundary between healthy and dead tissue but a gradual transition from one to the other. The colour becomes a bright greyish green as in hay. In fact this process, where desiccation proceeds so quickly that enzymatical destruction of chlorophyll cannot take place through lack of water, may be compared to hay formation. Part II. This describes experiments which show that the citrus leaf makes considerable use of its stomata in effecting transpiration. This is contrary to the opinion of Coit and Hodgson who stated (*Univ. Calif. Publ. agric. Sci.*, 1919, 3 : 283-368) that the stomata of citrus lose their regulatory capacity early in life, and that evaporation takes place through the walls of the ventral epidermis and through the dorsal surface which was then believed to contain no stomata. Rabinovitz-Sereni (*Bull. R. Stazione di Patologia vegetale di Roma*, 1931, 9 (n.s.) : 3-8) has shown that stomata exist on the upper midrib epidermis in sweet and sour orange, mandarin and pummelo. Part III. The daily course of stomatal opening and closing is traced and correlated with transpiration. The importance of stomata as regulating factors in transpiration of citrus leaves is proved again by the complete parallelism of the values shown. The actual movements of stomata on dull days in midwinter were as follows : closed or nearly closed at night, open shortly before sunrise and closed shortly after sunset ; at midday there was a characteristic,

rather sudden closing of stomata and reduction of transpiration due to the growing water saturation deficit in the leaves caused by strong morning transpiration. Reopening of pores takes place at about 2 p.m. The final closing begins at 3 p.m. and continues slowly until an hour after sunset. Under Palestine conditions citrus trees show considerable physiological activity in the winter months.

433. Blanchard, V. F. 634.3-2.183
Depressing effects of wind on growth and yield of citrus trees.
Calif. Citrogr., 1934, **19** : 206.

The detrimental effect of wind on coastal citrus orchards not adequately protected by windbreaks is described. A protected orchard will gain two years growth out of five over an unprotected orchard. In yield expressed as field boxes the protected trees (orange and lemon) produced 286 field boxes per acre of 80 trees, while the unprotected trees produced 43·6 per acre of 90 trees. Expressed as number of fruits per tree the protected trees averaged 288 fruits, the unprotected trees 55 fruits. All protected trees exhibited a greater vigour and general thriftiness than the unprotected. The point is made that a windbreak planted as is usual at the same time as the orchard can only protect a few rows and will not be fully effective for many years. An interesting photograph shows the reduction in growth caused by a gap in the windbreak on the trees opposite the gap. Trees situated on either side of the wind stream through the gap are fully twice as large as those in its path.

434. Cameron, S. H., and Appleman, D. 634.31 : 581.192
The distribution of total nitrogen in the orange tree.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 341-8, bibl. 2.

The material used consisted of Valencia orange trees, 3½ years old, 10 years old, and 12 years old. Seasonal fluctuations in nitrogen content of representative parts of the young tree are shown graphically. Data from older trees are tabulated. The normal custom in California citrus orchards is to supply each mature bearing tree with 2 to 3 lb. nitrogen yearly. The study described here represents one phase of an attempt to decide how much of this nitrogen the tree actually uses and when it needs it. Indications are given that some of the nitrogen present in the tree during autumn and early winter constitutes a reserve. At no time in these investigations was it found that the roots contained more than 21% of the total nitrogen of the tree. Even excluding the leaves, which contain some 40% of the nitrogen of the 10-year-old tree and about 60% of that of the young tree, the above ground portions of the tree hold as much or more nitrogen than the roots. They would not appear to be an important storage region. In the opinion of the authors such storage as does occur is in the leaves.

435. Bennett, A. H., and Tarbert, D. J. 634.3 : 577.16
Vitamin C. in citrus juices.
Biochem. J., 1933, **27** : 1294-1301, bibl. 8.

The authors give the results of experiments in which titration with Tillman's reagent, dichlorophenolindophenol, has been applied to the examination of lemon and orange juices in order to determine the degree of natural variation in the content of ascorbic acid and the conditions which determine its preservation or disappearance in storage. It was found that lemon and orange juices without any added preservatives could be kept for long periods without any appreciable diminution of their reducing power. The use of any preservative, however, which was efficient in preventing fermentation was followed by the gradual diminution of the reducing power which totally disappeared in a few weeks at most. The same result was also effected by strong acidification, pasteurization or boiling. It is concluded that in untreated juice the reducing factor is protected from atmospheric oxidation by the action of an enzyme, and that when this action is inhibited by any of the usual means, the reducing power is rapidly lost. [From authors' summary.]

436. COPEMAN, P. R. V. D. 634.31 : 581.192
Variation in the fruits of Washington Navel oranges with reference to the standardization of quality by means of the sugar/acid ratio.
J. Pomol., 1934, **12** : 81-98, bibl. 11.
The author discusses the different methods of assessing fruit quality or palatability by chemical tests and calculations. A large number of observations were made by him, during investigations on changes of composition during ripening, of the soluble solids and of the sugar and acid content of the juice of such oranges. Data are thus provided for a consideration of the various factors determining the sugar/acid ratio in commercial practice. He shows that the sugar/acid ratio is a linear function of the Brix/acid ratio, hence the latter can take the place of the former without any necessity for converting the Brix reading to a volume percentage. He points out that neither the sugar nor the soluble content alone provides a suitable basis for judging the quality of the fruit and suggests that, since the acidity at the critical stage must be closely related to the flavour of the fruit, the acid content of the juice by itself will provide nearly all the required information.

437. REICHERT, I. D. 634.3-2.3/4
The state of research in citrus diseases in Palestine.
Hadar, 1934, **7** : 115-7.
Brief notes are given on the more important of the many diseases to which citrus is subject in Palestine and the present state of research on each is stated. The needs of the country as regards the organization of further research are surveyed.

438. BACH, W. J. 634.3 : 581.144.2 : 632.3/4
Root diseases of citrus.
Citrus Ind., 1934, **15** : 6 : 20-2.
Some common diseases are described and remedial measures suggested.

439. PARKER, E. R. 634.3-2.19
Effect of certain zinc sulphate sprays for mottle leaf of citrus.
Calif. Citrogr., 1934, **19** : 204.
The article is written to emphasize the danger of using zinc sulphate sprays without lime for mottle leaf of citrus. The inclusion of lime renders the zinc very much less soluble in water. The spray formula of zinc sulphate 5 lb., lime 0, water 110 galls. with blood albumen spreader is compared for spray damage with a formula of zinc sulphate 10 lb., hydrated lime 5 lb., water 100 galls. At Riverside Experiment Station the use of the zinc sulphate without lime on Valencia orange and grapefruit caused much leaf damage, partial defoliation, and in some cases the loss of the entire first cycle of spring growth. Terminal buds were frequently killed and small twigs were occasionally lost. Fruit was also often badly spotted. No damage resulted from the use of the formula containing lime although the amount of zinc sulphate was doubled. The effect of the sprays on the disease are not yet fully ascertained, but the formula containing lime so far seems to have given as effective control as that from which lime was omitted.

440. QUAYLE, H. J. 634.3-2.752
Effect of temperature and humidity on fumigation for red scale.
Calif. Citrogr., 1934, **19** : 264.
In the fumigation of citrus trees in California with hydrocyanic acid the safety range for atmospheric temperature has been between 40° and 80° F. and for relative humidity between 30 or 40% and the point where visible moisture appears on the foliage. Experiments on the effect of temperature and humidity on red scale and on the plant gave the following results. *Effect of temperature on red scale.* Lemon fruit brought from ordinary room temperature showed no significant difference in the red scale killed between a temperature range of 50°-90° F. Infested lemons preconditioned by being kept in air conditioning cabinets for from 4-48 hours showed no influence from time of conditioning, but the red scale showed a higher percentage mortality on

fruit preconditioned at the lower temperatures. There was no difference in destruction of red scale on fruit preconditioned at 35° F. and at 50° F. *Effect of humidity on red scale.* Trials were carried out in gastight enclosures to eliminate effects of high humidity in tightening the tent. No significant difference was shown in the number of red scale killed when humidity ranged from 50 to 59% compared with 80 to 89%, the temperature in both cases being 65° F. Comparing the extremes of humidity, namely 22-50% and 90-100%, there was apparently a decrease in the number of scales killed with excessive humidity. *Effect of temperature on plants.* A larger number of rooted lemon cuttings were injured when fumigated at 50° F. than at 90° F. with a relative humidity of 70%. These plants had been preconditioned at temperatures similar to those at which they were fumigated. *Effect of humidity on the plant.* More plants were injured when fumigated growing in dry soil than in wet soil.

441. MCGREGOR, E. A. 634.3-2.73
Investigations of sulfur dust for citrus thrips and certain scales.
Calif. Citrogr., 1934, **19** : 232, 254-6.
It is shown that the insecticidal effectiveness of sulphur dusts used on citrus is positively related to the percentage of sulphur that will pass through a 325 mesh screen. Sulphur of this degree of fineness was effective against thrips, citricola scale, and black, and yellow scale, but not against red scale. A risk of sulphur burn may arise from the presence of moisture on the trees in conjunction with a hot sun. This sometimes occurs on the north-east side of the trees when the rays of the rising sun strike the fruit before the night surface moisture has evaporated. The limiting factors of sulphur are discussed. (1) At present it is only really effective in the hotter inland districts, (2) it has little effect on red scale, (3) the prolonged dusting schedule necessary to control black scale provides a risk of burn during the summer months, especially in orchards protected by windbreaks. A new type of dusting machine is described by means of which the dust is blown vertically up into the tree from underneath thus giving more effective control against scale and reducing the sulphur burn hazard.

442. ZARETSKII, A. JA. 634.451
The Japanese persimmon.*[In Russian.]
Inst. Pl. Ind. Leningrad Sci. Pop. Ser., **37**, 1934, pp. 54.
Starting with a brief review of the history of its cultivation, which began evidently in China and thence spread to Japan and later to Europe, the author then gives a botanical description of the genus *Diospyros* and the main cultivated species, *D. virginiana*, *D. Lotos*, *D. sinensis* and *D. Kaki*. The area of cultivation of the latter species, the chemical composition and vitamin content and the influence of pollination on fruit and on the yield are all discussed briefly, followed by descriptions of the most important varieties. The work terminates with short sections on cultivation and utilization.

443. NOGUCHI, Y. 634.451 : 575.18
Metaxenia in the Japanese persimmon : shape and sweetness.
Jap. J. Bot., 1934, **7** : 61-71, bibl. 9.
The author was able to establish incidence of metaxenia in Japanese persimmons. This was shown not by changes effected in the size of the fruit but in its shape and sweetness. Thus the fruit of round fruited types pollinated with pollen from pointed fruit varieties became somewhat more pointed and that of sweet fruited types was undoubtedly changed by the pollen of an astringent type, the fruit flesh, especially that near the seeds, becoming more astringent.

444. MASSA, L. 634.1/8
Le piante da frutto coltivate in Eritrea. (**Fruit plants cultivated in Eritrea.**)
Agricoltura colon., 1934, **28** : 225-37.
Brief notes on the different types of fruit grown include information on altitude, diseases and pests, particular points on cultivation, use of product etc. Free distribution of material is made

* Abstract received from the Imperial Bureau of Plant Genetics, Cambridge.

yearly by the government nurseries at Filfil, Dogali, and Adi Ugri. Among tropical plants may be mentioned *Anona* spp., mangoes, dates, bananas. All citrus varieties would appear to flourish. The pear has not been successful on the whole, though excellent specimens of the Duchesse d'Angoulême have actually been produced on one estate. Apple growing is fairly successful, a variety very similar to Calville Red proving amenable to the climate at least above 1,800 metres. Apples are badly attacked by woolly aphis. The peach varieties so far tried are short lived. The grape vine flourishes and phylloxera is so far unknown. In Eritrea the vine has only a very short resting period and normally gives 3 crops in 2 years, some 5 to 6 months after pruning. Local varieties of table grapes grown from cuttings have so far proved superior in growth to grafted Italian varieties.

The following also are noted :—

HAY, S. **The South African orange and grape-fruit.** *Food*, 1934, **3** : 179-81. (A popular account of the working of a South African citrus farm.)

TOXOPEUS, H. S. Onderzoekingen over den invloed van temperatuur en vochtigheid op de levens-processen van *Phytophthora parasitica*. (**On the influence of temperature and humidity on the life processes of *Phytophthora parasitica*, the cause of gum diseases of citrus.** [English summary.] *Landbouw.*, 1934, **9** : 385-421.

KINNISON, A. F., AND FINCH, A. H. **Some effects of special practices influencing the nutritional balance on yield, texture and time of maturity of grapefruit.** *Proc. Amer. Soc. hort. Sci.*, 1933, **30** : 95-7.

REICHERT, I., AND OTHER. **Xyloporosis—the new citrus disease.** *Hadar*, 1934, **7** : 163-7, 172. [To be continued.—ED.]

HALMA, F. F. **Size and age of budwood in relation to size of yearling citrus scions.** *Proc. Amer. Soc. hort. Sci.*, 1933, **30** : 373-4.

TROPICAL CROPS.*

445. HAVILAND, P. H. 631.459

Soil erosion.

Bull. Minist. Agric. Southern Rhodesia, **923**, 1934, pp. 31, being reprinted from *Rhod. agric. J.*

The author considers both wind (or Aeolian) erosion and water erosion and discusses practices which tend to encourage or prevent it. He notes that grass should be cut or grazed but not burnt and that reafforestation should always follow cutting down of timber or brushwood. Overstocking leads to overgrazing and hence to erosion. Roads should be drained. In the protection of cultivated land storm water drains of adequate size should be made at the heads and sides of all lands. Approximate dimensions of such drains are suggested for catchments of different sizes and hints are given on construction. Ridge terracing is advocated as the most efficient method of preventing washing on cultivated lands. These terraces are long, low mounds of earth running on a grade across the slope of the land, behind which the silt collects and the surplus storm water drains off. A typical layout of a land with ridge terraces and storm drains is shown in plan and notes are given on their construction. Discharge from ridge terraces must be arranged and may be into artificial storm drains or natural water courses or virgin land with a good vegetal covering. Gulleys may be prevented from causing further erosion by forming steps in the beds. These are made by excavating trenches and filling with wire-netting full of well packed stones.

446. DENNETT, J. H. 581.084.2

The layout of field experiments.

Malay. agric. J., 1934, **22** : 276-83.

An outline of the standard methods of layout and conduct upon statistical lines of a simple field experiment.

* See also 388, 503.

447. Traub, H. P., and Auchter, E. C. 631.52 : 634.653 +634.441 +634.651
Propagation experiments with avocado, mango and papaya.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 382-6, bibl. 3.

Tests were made in Florida of the efficacy of eight kinds of propagating media both used alone and in certain combinations of equal proportions in the germination of two varieties of avocado and one of mango. For avocado 10 mesh charcoal alone, and carex peat + sand + charcoal proved most effective in the rainy summer season when temperatures were high and watering was not required. When watering became necessary in the drier, cooler autumn, cypress sawdust +charcoal also became efficient. During the rainy season proper 6 and 10 mesh charcoal, sphagnum peat, sand + charcoal, cypress sawdust + charcoal and carex peat + sand + charcoal gave the highest percentages after 7 weeks. In the dry season carex peat + sand and sphagnum peat + sand proved best. Sphagnum peat and cypress sawdust + charcoal produced the most healthy and thrifty growth of seedlings during the rainy season, and sphagnum peat + sand and carex peat +sand + charcoal in the dry season. The use of 10 mesh charcoal always accelerated germination. Mango seedling results were less clear, but fine sandy loam proved definitely inefficient. In tests of germination of very immature seeds from fruits shed during the June drop a small percentage sprouted and of unripe fruits blown from the trees on September 3rd 95% of seed germinated. The avocado being very prone to fruit shedding, the possibility of germinating immature seed may save valuable breeding material. In tests on the sprouting of fractional embryos, separated and also halved cotyledons will sprout, provided that a fragment of meristematic tissue is attached to each portion. Still smaller portions show delayed or reduced sprouting. Plants from fractional embryos are slower in above ground development but equal in root development to whole embryo plants. Methods of grafting are described whereby (a) fractional embryos are grafted on to nursery stock or large trees, and (b) scions 2-5 inches in length are grafted into fractional embryos. A description is also given of a method of grafting on to a whole sprouting mango embryo. [These descriptions are too lengthy to give in full, and, since each of the many details is important, cannot usefully be abbreviated. A full account will be sent on application.—Ed.] Experiments in the rooting of cuttings of papaya, mango and avocado have been unsuccessful so far.

448. Krug, C. A. 633.73 : 576.3
Beitrag zur Cytologie des Genus *Coffea*. (**The cytology of the genus *Coffea*.**)
Züchter, 1934, **6** : 166-8, bibl. 6.

The author reports on work done at the Agronomic Institute of the State of São Paulo, Braz l, since 1929. He summarizes as follows :—Five different sorts of *Coffea arabica* were submitted to cytological examination by the author. They were found to possess 44 chromosomes. Results did not agree with those of Faber who found that the chromosomal number of *C. arabica* was 2n = 16, but confirmed Homeyer's view that the basic number is n 11. Three other species, *C. excelsa* Pierre, *C. canephora* (robusta coffee) and *C. congensis* Froehner have only 2n = 22 chromosomes. These chromosome figures explain the sterility of certain interspecific crosses in Java.

449. Ferwerda, F. P. 633.73-1.541.31
The vegetative propagation of coffee.
Emp. J. exp. Agric., 1934, **2** : 189-99.

The most successful method of propagating coffee vegetatively in Java is by cleft grafting. The scions generally used are the middle sections of strong water shoots which are just turning woody. The sections should be cut through the middle of an internode. A seedling stock of the same thickness as the scion is used and grafting is performed in the usual manner except that the graft is bound only and not waxed. It is, however, protected by means of a paper sheath or glass tube. A suitable height at which to cut the stock is 20 cm. above soil level. In six months the union is so complete that the point of junction can scarcely be detected. An experienced grafter will make 100-150 grafts a day of which 75 to 90% will be successful in dry weather. Scions of lateral shoots will produce flattened shrubs with prostrate branches. Scions from upward

growing lateral branches have, it has recently been discovered (*De Bergcultures*, 1933, 7 : 587-98), a tendency to produce intermediate forms, some of which are remarkable for their very strong growth, high yield and high degree of immunity to attacks of the branch borer *Xyleborus* sp. The practical advantages of vegetative propagation of coffee are :—uniformity of habit, and of size of berry and bean ; simultaneous cropping of grafts from one mother tree so that by a proper selection of clones the harvest can be spread over a longer period, which has several financial advantages ; the possibility of getting economic coffee plantations on nematode infested soils by means of grafts on resistant rootstocks ; conversion of poor yielding bushes by topworking. Stock trials with stocks raised from seed of self-pollinated plants showed that the degree of compatibility between rootstock and scion varied according to the particular combination of scion and stock involved. Low yields of grafted plants in large monoclone plantations led to the discovery that cross pollination with compatible and simultaneously flowering varieties was necessary to ensure setting except in the case of *C. arabica*. It is expected that the best results will be obtained from a mixture of five suitable clones. In recent experiments interclonal plantings have shown a yield 1½ to 2 times greater than comparable monoclone plantations.

450. Trench, A. D. 633.73 : 581.144.2
Preliminary observations on coffee roots in Kenya.
Bull. Dep. Agric. Kenya, **2** *of* 1934, pp. 10.

It is shown that the health of a coffee plant is not dependent on a tap root, but that well developed laterals and vertical roots, the latter being important during periods of drought, are essential. It is, therefore, obvious that manurial and cultural measures should be adapted to the desired development as well as to the needs of the existing system. In order to extend the surface roots while at the same time encouraging them to find depth it is suggested that the most economical method would be to trench or to subsoil down the centres of the rows of coffee and to apply organic manure in the trenches together with a light surface broadcast of manure between the trench and the stems. For soil already poor subsoiling and deep manuring throughout is advised as a preliminary, after which attention should be devoted to building up the humus content of the surface soil. Soil aeration is important and can be materially assisted by the growing of cover crops or by vertical forking. No hard and fast rule can be laid down as methods must vary with estate conditions, but in all cases the aim should be the production of a " general utility " root system.

451. Maublanc, A., and Roger, L. 632.752 : 633.73
La phthiriose du caféier. (**Phthiriosis of coffee.**)
C. R. Acad. Sci., Paris, 1934, **198** : 391-2.

This malady on the roots would appear to be initially due to scale insects of the genus *Pseudococcus* which break the surface of the roots. The fungus, probably *Polyporus coffeae*, lives saprophytically on the sugary liquids secreted by the insects or exuding from the damaged roots. Further investigations are called for on the biology of the insects.

452. Maublanc, A., and Roger, L. 633.73-2.452
Une nouvelle rouille de caféier au Cameroun. (**A new coffee rust in the Cameroons.**)
C. R. Acad. Sci., Paris, 1934, **198** : 1069-70.

The authors differentiate the new fungus from *Hemileia vastatrix* and suggest the name *Uredo coffeicola*.

453. Pyke, E. E. 633.74-1.535 : 581.144.2
The vegetative propagation of cacao. III. Observations on varietal differences in the rooting behaviour of cacao cuttings.
Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, pp. 4-7.

The material used was semi-hard wood taken from either fans* or chupons* and rooted in medium calcareous sand in a concrete cool frame. [For technique see *Second Ann. Rept. for 1932*, pp. 3-9,

* See 455.

H.A., 1933, 3:3:399.—Ed.] *Forastero Cacao.* There is marked dimorphism between the root systems of fan and chupon cuttings. In the fan the characteristic type of root system, in which the spread of the roots is at an angle between 72° and 60° to the vertical, is practically constant, whereas the chupons will exhibit a variety of root systems ranging from the vertical to the almost horizontal. In the chupon, however, there will always appear at least one vertical root. *Trinidad Criollo Cacao.* Both fan and chupon cuttings rooted as readily as Forastero, the mean period for rooting being about 3½ weeks. The cuttings, however, in both Criollo and Forastero tended to fall into two groups, one with a mean rooting time of 18·9 days, the other with a mean of 39 days. The direction of the roots was downward and spreading. *Surinam Wild Cacao.* This variety was slower in initial rooting than Trinidad Criollo but had caught up after 33 days. All sent out vertical roots. *Theobroma pentagona Bern.* (Alligator cacao.) This proved difficult to root and to harden off. The root system was similar to that of Forastero fan cuttings. *Theobroma angustifolia D.C.* This variety would only root in well rotted leaf mould and required from 40 to 90 days. The root system was characteristic and consisted of two or three stout main roots forming an angle of 45° to the vertical and developing lateral roots. *Theobroma bicolor* H.B.K. Callused well but failed to root.

454. Pyke, E. E. 633.74-1.535

The vegetative propagation of cacao. IV. Propagation by softwood cuttings under estate conditions.

Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, pp. 7-8.

Cuttings were rooted at the rate of about 50% under shade in portable wooden glass-lighted frames. The most successful rooting media were fine white sand or medium calcareous sand, overlying successive strata of fine and coarse gravel.

455. Pyke, E. E. 633.74-1.535 : 581.144.1

The vegetative propagation of cacao. V. Notes on the dimorphic branching habit of cacao.

Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, pp. 8-11.

An account is given of the habit of growth of the cacao tree. The crown of the tree is composed of plagiotropic lateral branches with a phyllotaxis of ½, i.e. the leaves are arranged in two ranks, the petioles being twisted so that the two ranks of leaves and the stem all lie in one plane. To these branches is applied the popular name of fan. They originate at the summit of the sapling or chupon growth of the seedling tree when this has reached a height of 3-4 feet. Orthotropic sucker growth (chupon) is usually sent up from the base of the trunk, and occasionally from the branches, frequently a chupon will grow up from just below the base of the crown. In the latter case the chupon will eventually branch into a fan and form a second storey to the tree. When vegetatively propagated fan branches will give rise to fans and chupons to chupons. Chupon material is greatly to be preferred for purposes of vegetative propagation but is not always available in sufficient quantity. The following investigations were undertaken to discover whether trees insufficiently endowed with chupon material could be induced to provide it. (1) *Pruning.* (a) The fan branches of seedling 3-year-old trees were heavily cut back leaving only short stubs from the main stem. Trees thus treated eventually produced a considerable number of chupons on their fan branch systems. (b) Trees grown from fan branch cuttings or layers take the form of low-branching bushes. The lower branches of these trees were cut back as in (a), but the fresh growth which resulted, though vigorous, was true fan. (2) *Ring-barking.* A complete ring 1 to 2 cm. in width was removed from stem or branch. (a) Cuttings or layers thus treated eventually formed a few chupons, in three cases below the ring and in one case from a cut back branch above it. A greater number of fan branches were formed at the same time. (b) Mature trees. No chupons were produced by ringing the fan branches of mature trees. (3) *Layering.* The method was to remove nearly all the leaves and to peg the young plant along the ground. The resulting growths were all fans with one exception. From these preliminary experiments it is concluded that a combination of ring-barking and pruning will convert vigorous fan cuttings, 1½ years rooted, into chupon plants which could then be either stooled, layered *in situ* or propagated as cuttings. Attempts to produce adventitious buds were fruitless.

456. Pound, F. J. 633.74 : 581.175.11
A preliminary survey of pigment factors in cacao.
Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, pp. 11-15, bibl. 3.

The presence of a red or purple pigment in the cocoa bean detracts from its value, since this colour is associated with bitter principles which have to be removed in curing or roasting, hence any methods of diagnosing plants which will produce pale beans must be of value in cacao plant selection. Very few Forastero trees give a pure white bean, but about 1 in 4 will give a light coloured bean instead of the usual purple. Lack of exact knowledge of the original parental types of Forastero cacao, of which on both sides there was certainly more than one, greatly hampers conclusions on the inheritance of any character. Of the white bean parents the most important is probably the dark red podded Venezuelan Caracas cacao. The purple bean genotype is possibly a true breeding Amelonado type with a yellow pod, resembling that cultivated in West Africa. Other possible parents are discussed and the broad hypothesis is formulated that pod pigments were introduced by the Caracas cacao alone. Thus it may be assumed that pod pigments were introduced by a white bean type and pigmented beans from plants whose pods were without pigment. Among the Caracas cacao, however, a few unpigmented pod types occur which produce only white beans, while there is in Java a white seeded variety whose pods have the outward appearance of the purple seeded Amelonado which is also suspected of having participated in the ancestry of Forastero. These facts explain the lack of linkage between those genes which are responsible for bean and pod pigments in the complex. No correlation has been found between bean pigment and the colour of the young leaf flush. Axil spot, however, i.e. colour at the junction of the petiole and the stem, appears only with dark red pods and white seeds and appears then to intensify the flush pigment. Thus a light flush cannot safely be taken to indicate a potential bearer of white seeds or a dark flush a tree that will bear purple seeds.

457. Pound, F. J. 633.74-1.541.5
The variability of budded cacao.
Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, pp. 15-21.

A quantitative comparison of seedling and budded cacao trees from the same 28 parents is here made with the object of discovering what reduction of variability may be expected from budded trees (on seedling rootstocks) as compared with seedling trees. The trees were planted in 1914 at the Cacao Experiment Station of the Department of Agriculture who supplied the records. Statistical analysis showed that even over a five year period uniform budwood on seedling rootstock does not give a very uniform yield, although compared with seedling trees from the same parents variation in pod number is reduced by more than 30%. The pod value analysis showed that the budded clone in the field may be regarded as an individual high yielding tree but it was estimated that at least two or three trees in each clone of ten were adversely affected by incompatibility of rootstock, while it also appeared that the root system could influence the size of bean produced by the scion and possibly the number of beans per pod.

458. Cheesman, E. E., and Pound, F. J. 633.74-1.521
Further notes on criteria of selection in cacao.
Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, pp. 21-4, bibl. 5.

An amplification is here made of the description of methods and criteria for selecting desirable types of Trinitario cacao which appeared in the *Second Annual Report on Cacao Research for 1932* [*H.A.*, 1933, 3 : 3 : 395]. The application of these methods to other cacao growing countries within the Empire is discussed and it is concluded that, since the Trinidad cacao population is the most complex, it is unlikely that difficulties arising elsewhere will be unparalleled in Trinidad, consequently, while Trinidad methods may possibly be conveniently simplified in other countries, they are unlikely to need elaboration. The West African cacao population is much the most restricted in its range of variation, but from examination of existing records it seems that there is sufficient variation to indicate that improvement of yield by selection by Trinidad methods could be

achieved. The standard, of course, need not necessarily be the same. Another point is the difficulty in distinguishing between results due to genetic and to environmental factors. The results of soil variation, however, generally extend to more than one tree. Thus when a good tree is surrounded by others above the average environmental influence is to be suspected, but if the neighbouring trees are normal then the superiority is probably genetic. The conclusive tests, however, can only be in detailed comparisons of the progeny. The danger of selecting and propagating a clone which is partially self-sterile does not appear to be very real, since it is almost certain that any tree which bears sufficiently heavily to be selected must be self-compatible. However, in the case of seedling progenies some segregation of self-incompatible progeny may occur, and that such segregation has partly accounted for the disappointing results obtained from some seedling progenies in the past is put forward as a possible hypothesis. Notes on " productive efficiency " follow. It is laid down that assuming the production of equal quantities of cacao per unit of land the most efficient trees are those which produce it in relatively few large pods ; assuming the production of equal weights of cacao between pods, those with fewest and largest beans are the most efficient, and in Trinitario cacao round beans are more efficient than flat beans. Efficiency is based on added value due to higher quality and in the case of large pods the decreased cost of picking and breaking is a further consideration. The choosing of a type of cacao suitable to each environment is one of the objects of selection and its importance is well illustrated by extracts quoted from *Bull.* 4, 1926, *of the Gold Coast Department of Agriculture.* In this connection it is pointed out that between countries totally different genotypes may be necessary for success in cacao cultivation.

459. Pound, F. J. 633.74-1.521
The progress of selection, 1933.
Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, pp. 25-8.

A description is given of the first 18 of the 100 cacao trees which are to be selected for their efficiency under the Imperial College selection scheme. [For an account of the methods and purposes of the selection scheme see *Second Annual Report on Cacao Research for 1932, H.A.*, 1933, 3 : 3 : 395.—Ed.] It is stated that whereas the yield from the heterogeneous types now grown rarely exceeds 6 cwt. to the acre, with the elimination of the poor bearers a yield of 30 cwt. per acre should be near the limit which the trees or soil can reach under present conditions.

460. Pound, F. J., and de Verteuil, J. 633.74-1.8
Studies of fruitfulness in cacao. IV. An experiment designed to test the gross effects of applications of nitrogen, potassium and phosphorus on the cacao tree.
Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, pp. 28-32, bibl. 3.

A fertilizer experiment has been laid down by the Trinidad Department of Agriculture and officers of the Cacao Research Scheme incorporating the most recent advances in the technique of field experiments as applicable to seedling plantation cacao. Any increases of yield are likely to be significant if of the order of 30%. It is hoped that the results will lay a basis for experimentation on genetically uniform cacao when the latter is available on a sufficient scale. [Authors' summary.]

461. Freeman, W. E.* 633.74 : 581.47 : 581.175.11
The inter-relation between pigment and pod morphology in cacao.
Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, p. 33, bibl. 2.

Owing to the superior quality of the light-coloured bean [see abstract 456] the possibility of predicting the probable characters of the bean within the pod from the external characters of the plant becomes of importance. In the investigations reported here the following correlations were made. *Bean colour and external pod pigment.* Red or almost completely pigmented pods gave a light bean percentage of 21·76 while the remainder gave a percentage of 14·55. *Bean*

* Dissertation abstracted by F. J. Pound.

colour and flush colour. The few trees which had no flush pigment in the young leaves gave a percentage of 70·54 of light beans. Greater or less degrees of flush colour showed no correlation with the colour of the bean. *Bean colour and axil spot (pigment at base of petiole).* A marked positive correlation between axil spot and pod colour but no correlation with bean colour. *Bean colour and pod shape.* Ridged pods have definitely more light beans and have smooth pods. Pods with bottle necks or stalk end constriction have a smaller percentage of light beans than pods without this constriction. Long-pointed pods contained 22% light beans as opposed to 15% in blunted or pointless pods. In a summary it is stated that the greatest percentage of light beans occurs in pods which have the greatest number of Criollo genes. In an appendix it is shown that bean colour is independent of the position which a pod occupies on the tree.

462. Marshall, J.* 633.74 : 581.162.3
Fertility in cacao.
Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, p. 34, bibl. 2.

Out of 21 average trees growing under normal estate conditions 7 proved to be consistently self-incompatible. Of the self-compatible trees the range of setting from hand pollination was from 72% to 10·8%, the behaviour of each tree being fairly consistent. From this consistency it is assumed that problems of self-compatibility are governed by genetic factors, although physiological factors may govern their expression. The effects of rainfall and humidity in this connection are discussed. The self-incompatible trees were cross-compatible with the self-compatible trees, but did not set fruit when crossed with self-incompatible trees. In the field natural cross-pollination is ascribed to insect agency, wind pollination being apparently structurally impossible. There appear to be peaks when natural crossing agents are more abundant than normally. It is concluded that through lack of adequate pollination all trees do not carry a maximum crop and that the amount of the crop depends on a very fine balance between physiological and genetical factors.

463. McDonald, J. A. 633.74-1.4
Cacao soil surveys.
Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, pp. 36-41, bibl. 4.

The cacao soils of the Montserrat district of Trinidad, Grenada and Tobago are subjected to a general comparison from which certain conclusions regarding the physical and chemical characteristics of good cacao soils have been reached. (a) The texture should be such that the soil is not subject to sudden or extreme fluctuations in its moisture status. (b) The optimum pH value is slightly on the acid side of neutrality but a wide range appears to be tolerated. Highly acidic reaction in heavy clay soils indicates conditions unsuitable for the growth of cacao. (c) The organic matter content of the soil is closely related to its productivity. This is particularly evident in areas where the use of artificial fertilizers is not a customary practice. (d) Relationship between the total nitrogen content and the yielding capacity of the cacao soils examined has not been found. (e) The average C/N ratio of the soil organic matter component for good soils is always greater than that for bad soils. This supports the view that the low yielding cacao soils so far examined in B.W.I. are relatively well provided with nitrogen. (f) There is a characteristic high content of available phosphate on high yielding cacao soils and a widespread deficiency on low yielding soils. (g) The same applies, but less markedly, in the case of available potash. (h) Harmful factors are the presence of definitely harmful concentrations of sulphate-ion derived from dissolved gypsum. The fact that many of the findings belong to all three areas indicates that the results may be of fundamental importance. The lack of balance in the nutrient status of low yielding cacao soils is discussed and it is pointed out that since the manurial needs of different types of soil appear to be highly specific a detailed soil survey is necessary before laying down any definite manurial treatment for any particular area.

* Dissertation abstracted by F. J. Pound.

464. McDONALD, J. A. 633.74-1.8
Manurial experiments on cacao.
Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, pp. 41-9, bibl. 6.

The difficulties in the way of obtaining reliable results from manurial trials of a perennial tropical crop such as cacao and the measures taken by the Chemical Section of Cacao Research to override them are outlined. The need for basing any manurial treatment on the results of previous soil survey work is emphasized. A description is given and the results presented of three different field experiments designed to test the response of the cacao tree to superphosphate manuring on different soil types in Trinidad. Increases in yield of the order of 50% have been obtained from treated plots the first year after the application of superphosphate. Although larger applications bring increased yield it is shown that from an economic point of view the maximum application of superphosphate with cacao at seven cents (3½d.) per lb. is 2 lb. per tree or 600 lb. per acre. The most efficient methods of layout for manurial trials on cacao, based on information gained from these experiments, are discussed.

465. McDONALD, J. A. 633.74-1.8 : 581.192
A study of the relationship between nutrient supply and the chemical composition of the cacao tree.
Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, pp. 50-62, bibl. 59.

The parts played by the principal nutrient elements in plant nutrition and the modern concept of physiological balance with respect to soil nutrients and manures are first explained. The results of investigations on cacao trees on two experiment sites follow. On Torrecilla Estate application of phosphatic manures increased the proportion of potash to nitrogen in the leaf, but when potash alone was applied the effect was less marked. It is concluded that the cacao plant is unable to obtain adequate supplies of potassium when phosphate is deficient. This may have an important bearing on present control measures against thrips. The present practice is to endeavour to reduce the nitrogen/potassium ratio by the application of potassic manures. It now appears that potassic manures may be useless in the case of deficient phosphate, and that phosphatic manures alone may be beneficial as a control in that they narrow the nitrogen/potassium ratio in the leaf. Normal phosphate manuring resulted in a more balanced nutrient supply (judged from the chemical composition of the leaf), but heavy applications (900 lb. superphosphate per acre) gave unbalanced nutrition, except when potash was also applied. On Santa Serviera estate phosphate manuring gave no increase in yield, although a marked increase in the amount of phosphate in the leaf was shown and a greater divergence in the composition of the leaf from the standard optimum values than was the case with the control. In this case the increased uptake of phosphate may be a luxury consumption. The deficiency may be one of potash, but other factors tending to low yield and poor condition are thought to be in operation here and to be masking any results due to shortcomings in nutrient level or nutrient balance. It is fully realized that the investigations will require further elaboration under different conditions of soil and nutrient supply.

466. McDONALD, J. A. 631.57 : 581.13
A critical examination of methods of measuring atmospheric humidity and rate of evaporation in ecological studies.
Third Ann. Rept. on Cacao Research for 1933, I.C.T.A., Trinidad, 1934, pp. 62-71, bibl. 4.

A number of different methods for measuring relative humidity and the evaporating ability of the air are examined with a view to ascertaining those most suitable for assessing the atmospheric moisture status of a particular environment in ecological studies.

467. Voelcker, O. J. 633.74 : 581.162.3
On a method of controlled pollination of cacao.
Reprinted from the ***10th*** *Annu. Bull. Dep. Agric. Nigeria*, 1933, pp. 2, bibl. 2.
The author describes with illustrations the method adopted and found very satisfactory by himself. Essentially it consists in enclosing the flowers in a box cover and so preventing the access of outside pollen. The box is a match box with fine gauze cloth gummed over one end of the outer cover, while round the other end an edging of green baize cloth $\frac{3}{4}$ in. wide is gummed, so that about $\frac{1}{16}$ in. overlaps the edge of the box. Passing right over the box is a tape which is sealed on to the box on both sides by sealing wax and enables it to be tied on to the branch where required. It is soaked previously in solignum to prevent damage by ants. The box and upper part of the green baize cloth are then varnished to make them waterproof. Two diagrams show how the box is fixed in position.

468. Joachim, A. W. R., and Pieris, H. A. 633.825-1.8
Ginger manurial and cultural experiments.
Trop. Agriculturist, 1934, **82** : 340-53.
Trials were carried out near Peradeniya to determine (1) which was the better yielding, the local variety of ginger or the Nugegoda, a degenerate type of Cochin ginger, (2) the effect of manuring on yields and the relative efficacies of artificial and cattle manure on each variety, (3) the effect of liming, (4) the effect of a mulch of straw, (5) the interaction between the various factors concerned. The trials were carried out on typically ginger growing land of rather exceptional fertility due to fallowing for some years. The situation was a steep hillside. The layout consisted of 3 blocks of 24 randomized plots, the plots being divided from each other by a drain 1 foot wide and 4 inches deep, and running down the slope. The results of the experiments as indicated by statistical analyses are as follows :—(1) Local ginger with a general average yield of 6·23 tons per acre showed an increase of over half a ton per acre or 9% over Nugegoda. (2) Manuring with cattle manure, 9·3 tons per acre, and with an artificial manure consisting of equal parts sulphate of potash, sulphate of ammonia and superphosphate at the rate of 5 cwt. per acre showed no significant difference between the two treatments but gave an increase of a ton per acre or 17% over the unmanured controls. (3) Differences due to liming were insignificant although the crop was grown on slightly acid soil. (4) A mulch of straw gave an increase of 16·5 cwt. per acre or 12·2% of the mean yield. This is attributed to the chemical and biological effects of decomposed straw, the season having been wet enough to make the effect of water conservation by the mulch unimportant. (5) Artificial manuring + mulching increased the yield by 38·6 cwt. of green ginger per acre ; cattle manuring + mulching increased it 34·6 cwt. The difference between the two treatments is not significant. (6) The profit or loss likely to arise from these treatments if used commercially is worked out. It appears that on these already fertile soils the treatments which will result in extra profit are organic or inorganic manuring + mulching. Either form of manuring alone will not show a profit except on poor eroded lands [*Trop. Agriculturist*, 1933, 80 : 262-7, *H.A.*, 1933, 3 : 3 : 403]. Further experiments showed that the optimum rate for planting seed ginger (=sets) is about 1 ton per acre. For curing purposes the planting of small sets is preferable to the planting of large hands.

469. Anon. 633.834
Die Muskatnusz (*Myristica fragrans* Hout.). (**The nutmeg tree.***)
Tropenpflanzer, 1934, **37** : 300-3, bibl. 3.
This is an account of the cultivation of the nutmeg tree. Research on its cultivation seems to have been lacking. It is a true tropical plant needing for success an unfluctuating high temperature and a yearly rainfall of more than 2,000 mm. falling at regular intervals. Shade and wind protection are essential. It is suggested that in the quarters destined for the trees first the ground should be thoroughly well prepared and planted with the trees which are to act as shade trees in the future, then bananas should be planted at about 4 metres apart to act as shade for the young

* See *H.A.*, 1932, 2 : 2 : 178.

plants for later removal, and finally, about 3 months after the planting of the bananas, the nutmeg trees of 1 to 1½ years old should be planted, great care being taken that the long tap root is not injured. As shade trees *Canarium commune*, various palms and also *Albizzia* have all been successfully used. Grenada, the Banda Islands and Malacca are the chief sources of the exported nuts.

470. Cramer, P. J. S. 633.912-1.541.5
Rubber. The use of improved planting material.
Trop. Agriculturist, 1934, **82** : 278-80 and 332-7.

The potentialities of the recently planted (since 1928 in Malaya, Indo-China and East Indies) large areas of monoclonal budded Hevea are first discussed. The average yield per acre of adult bud grafts may be estimated at twice that of normal yields from common plantings. When these recent plantings are in full bearing, 300,000 to 450,000 tons will annually come to the market at a cost of production of probably only half the figure for common plantings. Very few figures showing the yield of large clonal plantations have been published, but the smaller experimental plantations of 1918 show no signs of reversion with age to a lower level. The careful choice of the clone when bud grafting is decided upon is emphasized. The popular clone of one year may be in eclipse the next for some hitherto unsuspected weakness, or through the advent of a more brilliant successor. Instances of this are given. A plantation should grow at least four or five clonal varieties in order to distribute the risk, but these should be planted in monoclone blocks and not intermixed. The advantages of monoclone blocks are :—ease in thinning with no risk of removing a high yielder late in developing under the impression that it is a poor yielder ; the tapping system can be adapted to the clone and the tapper will always have the same quality of bark to deal with ; practically pure monoclonal seeds can be collected without difficulty. The production of new clones seems to have come to a standstill. The experiment stations are again turning their attention to seed selection, and the author predicts a return to seedling plantations after the depression has passed, but that the seeds will be from clonal plantations. The characteristics of certain clones are mentioned as instancing the number of factors that have to be considered when choosing a clone. Avros 36 suffers severely from wind as does Tjirandi 1, on the other hand BD.5 is particularly resistant. Avros 50 and BD.5 have open crowns allowing of light penetration and so of interplanting with some other crop. Disease resistance, wound recovery and bark renewal are other secondary characters of importance. In some clones the renewed bark when tapped gave such high yields that early first tapping to secure early tappable new bark was suggested. Ease of bud and stock union is another feature which varies with the clone, for instance Avros 50 and 152 will unite very much sooner when placed on 3-year-old stocks, whereas BD.5 is not so influenced. However, difficulty in budding should not be a reason for rejecting an otherwise first rate clone but only for paying extra attention to the work. [The article is to be continued.—Ed.]

471. de Jong, W. H. 634.441-1.541.5
Kweeken van mangga-plantmateriaal. (**Propagation of mangoes.**)
Landbouw, 1934, **9** : 518-19.

Employing the customary methods in Java to produce a saleable budded mango plant it takes about 3 years from the date of sowing the seed of the stock. A whole year has been saved by using the following method which differs from the usual one in that the stocks are not transplanted until the budded plant is fit for sale. Seeds were sown 40 cm. apart. After germination the surplus plants of the polyembryonic seed were removed with exception of the strongest. The taproots of those left in the beds were then cut by means of a spade thrust into the ground. This ensures a better root system. In 8-10 months the seedlings were ready for budding. Two months later (after an extremely successful " take ") the buds had already made their third storey. The root system of plants dug up for examination was as good as that of properly transplanted plants. By the end of the second year the plants will be large enough to send out as "stumps". In the ordinary way a year would have been wasted in transplanting stocks from seed beds to nursery beds prior to budding.

472. de Jong, W. H. 634.441-2.111
Berooken van mangga. (**The smudging of mangoes.**)
Landbouw, 1934, **9** : 514-18.
Following the successful results in the Philippines of experiments in smoking mangoes to induce early flowering (see *H.A.*, 1933, 3 : 1 : 111 and 112) a similar trial was undertaken in Java. Here 4 smoke fires were first lighted under a mango tree on March 3rd at which time the new shoots were full grown. The first flowers appeared 24 days later. [In the Philippine experiments flowers appeared in 7-9 days.—Ed.] The fires were continued for 8 hours daily until April 10th when the tree was in full bloom. No unsmoked trees were in flower. In the latter half of July when the other trees in the experiment station and neighbourhood were in flower the crop from the smudged tree was gathered. The yield was 797 fruits all told, the normal for the tree when untreated being from 1,000-1,500. The proportion of sound fruit, however, was above normal and the individual fruits were larger. Being out of season the fruit made nearly three times the usual market price, while the cost of smudging was infinitesimal. The smudged tree bloomed again normally in August, particularly on the north-east side which had not borne much fruit after the smudging. This second blooming yielded 200 good fruits.

473. Crawford, M. E. F., and Perry, E. O. V. 634.441 : 577.16
The vitamin content of the mango.
Biochem. J., 1933, **27** : 1290-3, bibl. 6.
Whereas in previous experiments* unripe mangoes had been used, on this occasion tests were carried out on ripe fruit. There was no striking indication that the maturity factor had any bearing on the vitamin content.

474. Malençon, G. 634.62-2.48
Nouvelles observations concernant l'étiologie du bayoud. (**Fresh observations on the etiology of the bayoud disease of dates.**)†
C. R. Acad. Sci. Paris, 1934, **198** : 1367-70.
The author summarizes as follows :—Our observations and investigations prove (1) that bayoud is caused by an organism in the *Fusarium* cycle which may be appropriately called *Fusarium albedinis* (Killian and Maire) Malençon, and (2) that this fungus produces external fructifications on diseased trees. These two entirely new data on the etiology of bayoud allow us to define its nature and method of propagation. As regards its taxonomic position, though admittedly *F. albedinis* must be placed in Wollenweber's *Elegans* section, further investigations will be necessary to determine whether it can be put in one or other of the sub-sections *Oxysporum* or *Constrictum*. It approaches *F. vasinfectum* in its morphology, but unlike the latter, which enters plants through the roots, it penetrates date palms by wounds made in the palms (leaves) and would not appear to use the soil as a medium of propagation. It may, therefore, biologically speaking, well be an autonomous species.

475. Chevalier, A. 634.771/3
Observations sur quelques bananiers sauvages et cultivés. (**Notes on some wild and cultivated bananas.**)
Rev. Bot. appl., 1934, **14** : 506-21, bibl. 4.
The author divides the banana into the edible fruit type and the fibre type. The first type he divides into two groups, namely, the *Musa paradisiaca-sapientum* and the *M. nana-Cavendishii*. He describes the peculiar characteristics of a number of the second group which are found in Indo-China. A short note is also given on the *Musa Fehi* Vieillard group and on the bananas indigenous to Indo-China. The fibre type of banana also includes a large number of species originating in the Far East or the Philippines. Finally a full botanical description of an ornamental variety, the *Musa Corbierii* sp. nov., is given.

* *E.M.B. publication*, 1932, *H.A.*, 1932, 2 : 2 : 188.
† See also earlier article on same subject. *C. R. Acad. Sci.*, 1934, 198 : 1259-61.

476. Abel, F. A. E., and others. 634.774 : 581.192
Indirect methods for the estimation of sugar in pineapple juices.
Pineapple Producers Co-op. Assoc. Ltd., Exp. Sta. Bull., **14**, 1934, pp. 27, bibl. 12.
The authors describe an attempt made to derive by correlation analysis relationships between per cent. sugars, Brix, acidity and refractive index of pineapple fruit juices in the hope that the relationships, when determined, would form the basis of furnishing a short but reliable method for estimating the amount of sugars in the juices.

477. Sideris, C. P., and Krauss, B. H. 634.774-1.8
The effect of sulfur and phosphorus on the availability of iron to pineapple and maize plants.
Soil Sci., 1934, **37** : 85-97, bibl. 20.
The authors draw the following conclusions from their experiments on Hawaian soils :—Pineapple soils with a high annual rainfall are relatively very acid, because they lack such water-soluble bases as K, Ca and Mg, most of the water-soluble minerals of these bases having been leached by rain and replaced with hydrogen ions. Pineapple plants grown in such soils respond well to phosphate fertilizers. This is due to the slight solubility of phosphates under such conditions, as they form various, relatively insoluble, compounds with either iron or aluminium which release water-soluble iron and phosphorus in quantities small but adequate for normal plant development. Pineapple soils with a low annual rainfall have relatively high pH values, namely 6·0 to 7·0, these high values being due to their high content of such bases as K, Ca and Mg combined with very strong or very weak acids. They do not respond to high or moderate applications of phosphates owing to their high pH values, at which phosphates combined with K, Ca or Mg are relatively soluble and interfere with the solubility of the small traces of water-soluble iron present. If such soils are rendered more acid with sulphur or with acid fertilizers or are supplied with forms of slowly available iron, they stimulate plant growth very appreciably even in the presence of moderate applications of phosphates. The biological method of determining iron deficiency is in the opinion of the authors, at least with certain plants, more sensitive than the chemical methods in use.

The following also are noted :—

Jolly, J. W. **Survey of cultivated fruits in Pahang, 1933.** *Malay. agric. J.*, 1934, **22** : 270-5.

Chandrasena, J. P. C. **The chemistry of the products of *Cocos nucifera*.** *Biochem. J.*, 1933, **27** : 3-4.

Reyes, G. H. **Banana black-tip disease in the Philippines.** *Philipp. J. Agric.*, 1934, **5** : 117-18, bibl. 3.

STORAGE.

478. Carne, W. M. 664.85.11 : 632.1
Wastage in Tasmanian apples.
Fruit World, Melbourne, 1934, **35** : 195, 197.
The apparently increasing liability of Tasmanian apples to internal breakdown (low temperature breakdown) after leaving cool storage is discussed. The most susceptible varieties are Cox's Orange Pippin, Sturmer, Scarlet, Jonathan, French Crab, Ribston. Among the factors contributing to this tendency to low temperature breakdown are considered to be increase in the use of nitrogenous manures, picking of fruit at an incorrect stage of maturity, unduly large fruit, with the possible exception of French Crab, seasonal effects (increased breakdown seems to follow a cool moist summer), soil type, mechanical damage, or some physiological unsoundness such as bitter pit. The following recommendations based on experiment for the picking and storing of susceptible fruit will probably if adopted reduce breakdown to a satisfactory minimum. (1) Larger than average fruit should not be stored. (2) The fruit should be picked on the basis of ground colour, i.e. when light green in Jonathan and Scarlet, in Sturmer when changing from

full to light green, in French Crab when almost full green, i.e. at the first signs of becoming lighter. (3) Store at a temperature of 35-36° F. rather than at the usual 32-34° F. (4) Larger sizes of stored fruit should be tested periodically by placing them in a warm room for not less than two weeks. If breakdown develops in the sample or in the stored fruit marketing should be proceeded with at once. Comparisons between fruit stored at 35-36° F. and at 32-34° F. should be made after storage when the fruit is warmed up, this being the time when breakdown mainly occurs. The market returns from fruit stored at each temperature should be kept separate for the purposes of comparison. Further experiments with fruit stored at 38-40° F. are to be made.

479. Hockey, J. F., and Boyle, J. A. 644.85.11 : 632.1
Gravensteins—time of picking in relation to spot scald.*
Sci. Agric., 1934, **14** : 608-13, bibl. 4.

This paper is based on observations made on the fruits of one tree which were picked at weekly intervals from August 26th until September 30th, about a bushel being taken on each occasion. The fruit was graded for size and colour, submitted to various tests, e.g. colour, pressure, starch content etc. and put into ordinary ventilated store. It was found subsequently that Gravenstein apples picked when most of the starch had left the core and was present in appreciable quantities in the flesh developed the least amount of spot scald. The prevalence of the disease was not appreciably affected by the sucrose and total sugars in the fruit. Picking when most of the starch had left the core area gave larger, more deeply coloured fruit, of better keeping quality than picking earlier. In the authors' opinion the iodine potassium iodide test is superior to the mechanical pressure tester for determining picking maturity in apples maturing about the same time as Gravensteins.

480. Tiller, L. W. 664.85.13.021
Use of copper-sulphate-treated paper in the cold storage of pears.
N. Z. J. Sci. Tech., 1934, **15** : 403-7.

In experiments in which pears were packed in close textured paper impregnated with 5·1% of copper sulphate (anhydrous) fresh *Botrytis* infection was confined to three pears out of three cases, although the top and bottom layers of these cases consisted of infected pears, ranging from slight for case A to 75-100% infection for case C (classified according to surface visible affected by fungus). The control cases in which the fruit was wrapped in normal paper contained only one sound fruit at the end of three months from the start of the experiment. The question of producing an impregnated paper of this nature locally and the cost of importation from U.S.A. are mentioned.

481. Grasovsky, A., and Shiff, M. 664.85.31.035.7
The effect of ammonium bicarbonate on the storage of oranges.
Hadar, 1934, **7** : 168-72.

The data were obtained in 1931-2 and 1932-3, 3,178 oranges being used in the experiments. At first the experiment was restricted to preservation of oranges in a sound condition, but afterwards the bicarbonate was tested for its efficacy in controlling rots, i.e. green mould, blue mould and diplodia rot. Four cases were used in each trial : in the first case a pinch of crystals was inserted within the wrapper of each fruit, in the second the chemical was scattered between the layers of wrapped fruit, in the third it was scattered outside the case, the fourth case was not treated. Results are tabulated. The use of ammonium bicarbonate was found to lengthen the keeping period of sound, cull and bruised oranges and oranges from trees affected with diplodia fungus and oranges inoculated with moulds. It also gave results in controlling the spread of moulds and diplodia rot. The effect was greatest, the more closely the chemical was applied to the fruit. The chemical increased the development of a physiological breakdown known locally as Nuksans, but its mould control more than compensated for any loss due to this.

* See also *H.A.*, 1933, 3 : 1 : 126.

PACKING, PROCESSING, FRUIT PRODUCTS.

482. HARDING, P. L., AND OTHERS. 634.11-1.564
The effect of methods of packing on the condition of apples packed in barrels.
Proc. Amer. Soc. hort. Sci., 1933, **30** : 243-6.
Investigations followed complaints of the arrival in European markets of slack barrels of apples showing great bruising. Tentative results included the following :—Insufficient filling, racking or shaking is the cause of the trouble. It is suggested that shaking* the barrels two or three times while filling, racking† 15 times with the " plug " or " follower " in place and then filling to $\frac{3}{4}$ inch above the tops of the staves seems sufficient to prevent appreciable settling of the apples in transit. Overfilling cannot replace racking and shaking. Refrigeration is useful with such varieties as Jonathan or Grimes Golden.

483. TURNBULL, R. F., AND LANGLANDS, I. 634.771-1.564
Tests on banana cases.
J. Coun. sci. industr. Res. Aust., 1934, **7** : 99-104.
A report of the investigations of loss due to mechanical failure of banana cases used in transporting bananas from Queensland and northern New South Wales to the southern States. The main failure was found to be due to nail heads pulling through the top boards due largely to the use of excessively thin and soft timber, to excessive bulge and to splits. Other causes of failure were the wood shearing from the nails, withdrawal of nails, breaking of top boards. The standard banana case for this trade is one measuring 25″ × 12″ × 12″. Each end is of two pieces, $\frac{3}{4}$″ thick, held together by two cleats $1\frac{3}{4}$″ wide × $\frac{3}{8}$″ thick. The sides are usually of 3 pieces, the top and bottom of 2 pieces, all $\frac{5}{16}$″ thick. A bulge pack of from $\frac{1}{4}$-$2\frac{1}{2}$″ is used. The principal timbers used are hoop pine (*Araucaria Cunninghamii*) and rose gum (*Eucalyptus saligna and E. grandis*). The nails are $1\frac{3}{4}$″ long, 14 gauge, 6 nails being used per edge. In the investigations laboratory tests were devised to determine the influence of the principal factors affecting strength, namely species of timber, thickness of timber, nailing schedule, wiring, extent of bulge, when varied within commercial limits. Results were as follows :—Eucalypt timbers, rose gum, white gum (*E. micrantha*), blackbutt (*E. pilularis*) made the strongest cases, the two last being particularly good. A change from $\frac{5}{16}$″ to $\frac{1}{4}$″ thickness of wood in top and bottom produced an average decrease in strength of 40% in hard woods. In hoop pine a change from $\frac{3}{8}$″ to $\frac{5}{16}$″ produced a 16% average decrease in strength. Increasing the number of nails in tops and bottoms from 6 to 8 resulted in an average increase of strength of 38%. Wired cases proved four times as strong as unwired cases. Reduction in strength due to bulge was not serious up to a $1\frac{1}{2}$″ bulge. Beyond this it became dangerous. It is stated in conclusion that a more careful attention to nailing and the elimination of thin or defective boards would also materially reduce losses.

484. ADRIANO, F. T., AND OTHERS. 634.1/7-1.547.6 : 547.313.2
The handling of some Philippine fruits with special reference to the ethylene, borax and paraffin treatment.
Philipp. J. Agric., 1934, **5** : 87-104, bibl. 7.
Observations made daily on various citrus and tropical fruits subjected to ethylene treatment are tabulated. It was found that using a concentration of 1 part ethylene to 5,000 parts air once a day, the chamber being well aerated between treatments, Batanga mandarins, oranges, grapefruit, pummelos, lemons and limes could be coloured yellow in from 3 to 6 days without appreciable change in flavour. Subsequently the soaking of the fruits in 4% borax, drying and treating with a solution of paraffin in a white colourless and tasteless mineral oil solvent resulted in fruit of very good appearance, probably due to restriction of moisture loss and slowing down of rate of respiration. Precooling of the fruit at 35° F. after this treatment was found to lengthen the life of the fruit. Ethylene treatment of chicos and mangoes was not successful, but avocados ripened in 2 to 3 days by it.

* i.e. settling fruit by giving barrel 3 or 4 quick sharp jolts.
† i.e. a vigorous tipping backwards and forwards of the barrel when nearly full.

485. REED, H. M. 634.37-1.56
Improved methods of utilizing the Magnolia fig.
Bull. Tex. agric. Exp. Sta. **483**, 1933, pp. 20, bibl. 8.
Investigations on improved methods of processing have shown that :—(1) 2% lye solutions are found to be satisfactory for peeling figs. (2) Dipping in an acid solution (0·5% HCl) after the completion of the lye peeling process slightly improves appearance and flavour. (3) Dipping in a boiling 2% baking soda solution for 30 seconds and rinsing in water is an adequate substitute for the lye peeling process. A process for canning in light syrup is described as also a new process for candying the figs. Sulphurous acid (1,000 parts per million) is a good temporary preservative for magnolia figs. Most of the acid is removable by leaching with water. Figs so treated were fair in appearance, but lacked flavour. They were found to absorb artificial flavour and colour readily.

486. BARKER, B. T. P. 663.3
Cider fruit culture in relation to modern requirements.
Long Ashton Res. Sta. Ann. Rept. for 1933, 1934, pp. 17-36.
The author reviews the present position in the English cider industry, and notes how it has been reached. He gives advice and reasons for this advice as to action in the immediate future. The total value of sales of cider in this country has risen since before the war, yet despite this the acreage under cider apples has been allowed to drop considerably and adequate steps have not been taken to make good the deficiency. He considers that the leeway to be made up is some 30,000 acres, and that even if trees are planted now they will not be cropping on a commercial scale for some 15 to 20 years. Among recommendations made by the author regarding new plantings are the following :—(1) Reduce the number of varieties in an orchard to a minimum consistent with satisfactory fruit production (pollination must be assured). (2) The total number of varieties used for cider should be reduced so that the trade may be assured of a bulk supply of reasonably uniform fruit. (3) In any orchard varieties should be grown the fruits of which ripen at about the same time, so making for economic harvesting. (4) Sorts should for years to come be limited to the bittersweet or sweet class—the former preferably—to enable blending with cull apples—except for such outstanding sorts as Kingston Black and Foxwhelp. (5) Normally only varieties combining orchard merit with good vintage quality should be planted. (6) True vintage varieties such as Frederick should not be allowed to die out. Notes are given on soil and type of tree, and on planting and spacing. On the ground that the length of life of trees on vegetatively raised stocks is still uncertain the author recommends the use of seedling stocks. He notes, however, that the possibility of quick production by the use of dwarfing or semi-dwarfing stocks is being examined and that Long Ashton has now made provision for exhaustive trials over a wide area. As regards actual varieties the author reproduces the list drawn up by a joint conference of the N.F.U., the National Association of Cidermakers and the Long Ashton Station in 1932 and adds to it several other varieties to fill the gaps and enable it to cover completely the entire season of cider making.

487. CHARLEY, V. L. S. 663.3
The action of cider on metals.
Long Ashton Res. Sta. Ann. Rept. for 1933, 1934, pp. 152-74, bibl. 6.
The author notes the many ways in which cider during its manufacture is exposed to metal contamination. He discusses the general characteristics, as affected by contact with cider, of various metals which have been used or suggested for use with cider. These are silver, copper, lead, iron, aluminium, zinc and tin. He next proceeds to explain the experimental methods adopted at Long Ashton for determining the resistance of different metals or alloys to cider corrosion. Strips of such substances were suspended after cleaning in 550 c.c. of the appropriate test solution and left for two months and in some cases for 6 or 12 months. He notes that despite the interesting results actually obtained such methods do not adequately represent the normal wear and tear of cider machinery. The strips of the following materials were used :—austenitic cast iron, chrome-nickel steel (two types), corrosion resisting steel, acid-resistant bronze,

bronze, cupro-nickel and duralumin and another form of aluminium in addition to the above-mentioned metals and gunmetal. They were immersed in sharp cider (0·7% malic acid and 0·2% tannin), bittersweet cider (0·25% m.a. and 0·49% tannin), and acetified cider (0·36% m.a., 0·18% tannin and 0·3% acetic acid). Finally an attempt was made to estimate the amount of tin and copper left in filtered ciders. The author summarizes as follows :—(1) The importance of preventing contact of cider with metallic surfaces is shown. (2) It is indicated that the chief source of trouble arising from metallic contamination of ciders is their characteristic metallic taste. (3) Several alloys have been shown to possess satisfactory resistance to cider under the condition of the tests. (4) Sharp, Bittersweet and Kingston Black ciders have been shown to dissolve only exceedingly minute quantities of copper during filtation through a tinned-copper pulp filter.

488. Charley, V. L. S. 663.3
Fermentation control of ciders by the centrifuge method.
Long Ashton Res. Sta. Ann. Rept. for 1933, 1934, pp. 145-51, bibl. 2.
Experimental results allow the author to make the following concise statement, the various points of which he discusses at some length. " (1) The fermentation control increased in efficiency as the gravity of the treated ciders became lower. (2) Practically complete fermentation control was obtained at a gravity of 1·024 by a single centrifuging. (3) Complete cessation of fermentation was effected by treatments at 1·017 or 1·007."

489. Lange, F. J. 633.85
Öle und Fette in der Wirtschaft der Eingeborenen Tropisch-Afrikas. (**Oils and fats in the national economy of native, tropical Africa.**)
Tropenpflanzer, 1934, **37** : 93-125 and 149-68, bibl. 279.
The author is primarily concerned with the production and consumption of animal and particularly vegetable oils and fats in different parts of tropical Africa. He deals first with animal fats and their use by the native. Next he considers the distribution of vegetable fats throughout the continent. He then examines the use made of the different fats in different zones, which he differentiates as the palm oil zone, groundnut zone, coconut zone, mixed oil zone, and shows how the primitive use of the unprocessed oil from untended trees has given place to certain refinements in processing and cultural operations. Finally, he shows what effect the entry of the European merchant and scientist has had in hastening improvements in cultivating, processing and handling these products. The comprehensive bibliography contains references not only to articles or books dealing with fats and oils and their African sources, but also to accounts of various African exploration expeditions and of life in different parts of native Africa.

490. Imperial Institute. 668.52
Essential oils from East Africa.
Bull. imp. Inst. Lond., 1934, **32** : 195-252.
The Imperial Institute has been closely associated with this new industry since its start and a large number of samples of different oils prepared by planters or local Agricultural Departments have been received for examination. Some are oils already known on the market, while others distilled from indigenous plants are examined to determine their commercial possibilities. In all cases the analysis is given of the oils received and where possible this is compared with that of oils already on the market or oils of other origin. In addition the comments of commercial firms likely to be interested have been invited and are given here. The oils considered include :—Geranium oil of several types from Kenya, 2 samples of geranium oil from Tanganyika, 2 samples from Uganda ; 3 samples of peppermint oil from Kenya, a sample from Tanganyika ; lemon grass oil from Tanganyika and from Uganda ; oil of *Cymbopogon afronardus* from Kenya ; oil from vetiver roots grown in Uganda ; *Eucalyptus citriodora* oil from Kenya ; patchouli oil from Uganda ; and other oils of different East African origins as follows :—cinnamon leaf oil ; *Aframomum amaniense* oil ; muhugu oil (*Bractylaena Hutchinsii*) ; Kawamala (*Coleus*) oil ; Kamynye (*Hoslundia opposita*) oil ; mujaja omunene (*Ocimum* sp.) oil ; *Ocimum menthaefolium* oil ; *Ocimum americanum* oil ; " Mlanje cedar " oil and wood ; *Zanthoxylum* sp. oil.

491. Worsley, R. R. Le G. 668.52
Some East African essential oils.
Bull. imp. Inst. Lond., 1934, **32** : 253-70.

The author gives the results of his investigations to date on essential oil-bearing plants, indigenous and cultivated, growing in or around Amani, i.e. at an altitude of 3,000 ft., the rainfall being about 80 in. A still made from a 10 gallon oil drum was found very satisfactory. All physical measurements are recorded for 20° C. The origin of the oils investigated are :—(1) *Aframomum mala* and *A. amaniense* Loes from (a) leaf, (b) seed, (c) peel, (d) root. The composition of these was found to be very similar except that of *A. amaniense* seed oil, and *A. mala* seed oil, the latter containing cineole. Reports of perfumery experts were in no case very favourable. (2) (a) Lemon grass, *Cymbopogon citratus*, (b) *C. Martini*, (c) *Vetiveria zizaniodes*, (d) *Melinis minutifolia*. It was hoped to get an oil which might be repellant to tsetse fly from the last, but it was found impossible to extract more than a trace of oil from it at all. (3) *Geraniaceae*, i.e. *Pelargonium* spp. The oils were found inferior to Algerian and Bourbon geranium oils, which are the standard for such oil. (4) *Rutaceae*, i.e. oil from the sour orange. The production of this oil has now been taken up by the Department of Agriculture of Kenya and the author only gives a very brief note on it. (5) *Ocotea usambarensis* or Ibean camphor tree. The report of the perfumery firm was very unfavourable. (6) *Cananga odorata*. This yields the Ylang-ylang oil of commerce. A perfumery firm reported that the 2 oils submitted were equal to good Bourbon oils. Distillation on a commercial scale would appear to have possibilities. (7) *Michelia Champaca*. Results were not encouraging. (8) *Lantana Camara*. The hope that the plant would serve as a new source for citral does not appear to be justified. (9) *Conopharyngia Holstii*. The oil yielded was not good. (10) *Cinchona* spp. It is suggested that the oil extracted might perhaps be used as a fixative.

492. Kalogereas, S., and Kotsonis, S. 665.327.3
Investigations of rancidity tests for oil from Greek olives. [Greek-French summary.]
Prakt. Akad. Athen., 1933, **8** : 169-73, bibl. 2.

The authors come to the conclusion that none of the colour reactions (Vintilesco-Popesco, Kreis, Fellemberg) are capable of determining rancidity : smell and taste still remain the best tests. The Issoglio reaction can, however, differentiate between refined and crude olive oil by reason of the smaller amount of oxidizable materials soluble in water present in the refined oil.

The following also is noted :—

Pickford, P. T. H. **Experiments on the improvement of the juice from culinary and dessert apples by maceration with pressed bittersweet pomace.** Progress report. *Long Ashton Res. Sta. Ann. Rept. for 1933*, 1934, pp. 141-3.

NOTES ON BOOKS AND REPORTS.

493. Parker, H. H. 633.79
The hop industry.
P. S. King & Son, London, 1934, pp. 289, references numerous, 8 appendices, 9 illustrations, 15/-.

This book supplies a long felt need, as no work on the hop industry as a whole has appeared in this country in recent times. The author deals with his subject in three sections :—(1) The development of the English hop industry up to the end of the nineteenth century. (2) The modern position. Cultural practices, diseases and pests, and recent research work are reviewed in the first half of this section, whilst the second half is devoted to hopgrowing in the dominions and abroad. (3) Methods and problems of collective marketing. Here the activities of the war time Hop Control and of English Hop Growers Ltd. are fully dealt with. The appendices contain much useful information, not least in the bibliographical section, which indicates not only the

source of existing information, but also those journals in which further results of research work are likely to appear. Every aspect of the industry is dealt with in detail. The book is written in non-technical language and will be found of value to all interested in any way with the industry, whether scientifically or commercially. F.H.B.

494. ATANASOFF, D. 632.8

Virus diseases of plants. A bibliography.

Houdojnik Printing Co., Sofia, 1934, pp. 219, $3.

The aim of this list is to bring to the attention of the student of plant virus the extensive literature on the subject and to facilitate the use of it. The references are mainly classified under plant families, nearly a third of the book being taken up by the misfortunes of the *Solanaceae*. Included in the work are some references on several diseases which are not of the virus nature but which the author considers could easily be taken for such. He also includes numerous references to one disease at least, i.e. bitter pit of apples, which is not generally accepted as being of a virus nature, although in his opinion it should be considered as such. [He has recently published articles setting out his views on this subject, see *H.A.*, 1934, 4 : 2 : 216 and footnote.—ED.] An index of authors and of host plants is included. It is stated that a supplement to this list will be issued annually.

495. INTERNATIONAL INSTITUTE OF AGRICULTURE. 31 : 63

The agricultural situation in 1932-3.

Int. Inst. Agric., Rome, 1934, pp. 580, 25 liras.

This is an economic commentary on the " International Year Book of Agricultural Statistics ". The commentary includes a general review of the agricultural situation throughout the world under the following heads :—Economic tendencies of world agriculture—notes on market conditions for each commodity—international action in connection with agriculture—government measures of farm relief, action taken by voluntary organizations in the interests of the producers —economic conditions of agriculture. Under the last three heads each country is treated separately.

496. CHESHUNT. 631.544 : 635.63/64

Exp. and Res. Sta. Cheshunt Ann. Rept. for 1933 (19th year), 1934, pp. 115.

Reports are given on the different branches of investigational work in progress. A summary of work is given in the introduction, from which the following notes are taken. Experiments now in their fourth year with nitrogenous fertilizers applied as top dressings to tomatoes continually throughout the season show similar results for sulphate of ammonia, nitrate of soda and nitrate of lime, and slightly better results during normal weather for Peruvian guano, dried blood and fishmeal. During hot years dried blood and fishmeal were most beneficial. As a base dressing the cumulative effect of shoddy slightly exceeded horn and hoof in the fourth year but not in the three preceding years. The use of cyanamide has given good results but its effects need further investigation. Root injury resulted from the experiment of planting tomatoes in trenches which were filled in as soon as the lowest trusses had been picked. The physical condition of heavy and medium soils can be improved by clean wheat or oat straw placed vertically in the soil to a depth of 20 inches. Peat for the same purpose is useful but expensive. Spent hops are variable and not lasting. Chrysanthemum roots are not recommended. The liming experiment after six years indicates clearly that, while light dressings constitute a safety measure, heavy dressings can be recommended only for improving the condition of heavy clay soils. Variety trials showed Klondine Red and Best of All types producing abnormally heavy crops under the influence of the exceptionally sunny weather. The Guernsey strain of Radio and the Guernsey Radio × Klondine Red gave the highest yields. Recommendations are made for heating the soil of commercial nurseries by means of a system of buried hot water pipes. By raising the soil temperature of 65° F. to 80° F. a 30% increase of yield was obtained. It is probable that the experiments on cucumbers will give similar result. Work with the new winter forcing lettuce,

Cheshunt Early Giant, has been continued and it is hoped that seed will be available for distribution in time for the next winter crop. The study of various glasshouse pests and diseases has been continued and the progress reports are to be found in this Annual Report. Physiological investigations in connection with problems of assimilation and translocation in tomato plants are reported.

497. Berlin-Dahlem. 634/5(43)(058)
Bericht der Lehr- und Forschungsanstalt für Gartenbau in Berlin-Dahlem für das Rechnungsjahr 1933. (**Report of the horticultural research institute at Berlin-Dahlem for 1933.**)
Landw. Jb., 1934, Band **79**, Ergänzungsband, pp. 137-58.

The report is divided into three portions, viz. :—(1) A report on the work of the different departments, (2) a report on the activity of the reseach stations which form part of the establishment and (3) a report on the field work on vegetables at Grossbeeren. These reports are in the form of short notes, references being given to articles published on the work elsewhere. Among the very many items noted are :—*Nursery work.* This has been chiefly concerned with the testing of new varieties or ornamentals such as geraniums, hydrangeas, chrysanthemums, begonias, cyclamen, primulas, violas. Other experiments have been carried out on proprietary fertilizers, on raising rhododendrons for special climatic conditions, on transplanting old conifers (*Picea omorica*, 40-year-old trees), on the merits of proprietary preparations for lengthening the life of cut flowers and of proprietary cardboard pots. It is stated that so far some 70,000 types of fruit plants have been obtained, have been kept under observation and examined for their suitability as rootstocks. They include 707 apples, 410 plums, 210 cherries, 147 pears, 40 quinces and 73 *Prunus Mahaleb*. The first results with plum stock trials are to hand and will be published shortly. *Plant protection.* Great success has attended a trial of methods designed to encourage the quick healing of wounds in stone fruit and apples. Briefly the method consists of enclosing the wounded limb in a bandage composed of gauze + cotton wool + gauze and covering the whole with a layer of water soluble asphalt, or of cement mortar, the bandage being impregnated with a solution of hexylresorcin or quinosol. Reports are made on various proprietary devices and solutions offered for the control of pests and diseases. *Other research items.* Testing of new fruit varieties and breeding of new fruit and flower varieties. Vegetative propagation of woody plants by the wiring method. Tests of fruit plants propagated in this way. Propagation of St. Julien plums by the wiring method. *Fruit preservation and storage.* Canning of fruits and vegetables. Preservation of unfermented fruit juices. *Experiments at Grossbeeren.* Vegetable variety tests. Mulching with paper and other substances. Tests of proprietary and common fertilizers on vegetables. Pot experiments with varying amounts of N, P and K. Weed control. Seed irradiation.

498. Geisenheim am Rhein. 634.8+634/5(43)(058)
Bericht der Lehr- und Forschungsanstalt für Wein-, Obst.- und Gartenbau zu Geisenheim am Rhein für das Rechnungsjahr 1933. (**Report of the viticultural and horticultural research station at Geisenheim for 1933.**)
Landw. Jb. 1934, Band 79, Ergänzungsband, pp. 29.

Very short notes are given of the various experiments in progress and references are provided to publications in which fuller details are to be found.

499. Ministry of Agriculture, London. 634.7 +634.37 +635.61
Fruit production. Soft fruits. 2nd edition.
Bull. Minist. Agric., Lond., **4**, 1934, pp. 63, bibl. in text, 1/-.

Since the previous issue of this bulletin in 1931 further research work has been published on various aspects of the subject. Nuts are not dealt with in the present edition, as it is hoped to publish a special bulletin on their culture. The different sections, which have been considerably revised, contain information on cultivation, varieties, marketing, pests and diseases of the following fruits :

strawberries, gooseberries, currants, black and red, loganberries, raspberries, blackberries, figs and melons, while a short note is given on dewberries, which have been brought to the notice of the English fruit grower as the result of their marked suitability for canning.

500. MINISTRY OF AGRICULTURE. 632.3/8 : 633/635
Fungus and other diseases of crops, 1928-32.
Bull. Minist. Agric. Lond., **79**, 1934, pp. 117, 2/-.
Brief notes are given of the latest work or discoveries regarding diseases of horticultural crops as follows :—potatoes pp. 20-37 ; vegetables pp. 51-65 ; fruit pp. 65-88 ; hops, mushrooms and flax pp. 88-93 ; ornamentals pp. 93-103 ; bulbs, corms etc. pp. 103-12. The notes do not go into detail but give adequate bibliographical references to sources of information.

501. BENDER, H. B. 582.88
The Fungi imperfecti, order Sphaeropsidales.
Published by the author, North Woodbury, Connecticut, U.S.A., 1934, pp. 52.
This is a key to the genus *Sphaeropsidales* and is the first publication of a series projected by the author dealing with the genera of the *Fungi imperfecti*.

502. FRUITGROWER. 634.1/8 : 338
Empire Trade Number of Fruitgrower, vol 77. No. 1994, 1934, pp. 369-412.
This special number contains articles on the following subjects :—Increased Empire supplies and the difficulties involved ; marketing of Empire fruit ; Dominion apples on the home market ; a British Empire fruit calendar for the home market ; New Zealand fruit transport ; how Empire fruit gets to the home consumer ; the story of fruit growing in South Africa ; receiving and distributing facilities at our fruit ports ; development of the pineapple in Queensland, the effect of Dominion dumping on the English apple season of 1933.

503. INTERNATIONAL INSTITUTE OF AGRICULTURE. 551.566.1 : 63 : 016
Bibliography of tropical agriculture, 1933.
Int. Inst. Agr., Rome, 1934, pp. 140, 10 liras.
This bibliography forms a useful reference to the more important technical publications on tropical agriculture issued during 1932. A short note indicating the scope of the article accompanies each title. [Note :—Full abstracts of the more important papers on perennial tropical crops alluded to in this bibliography will be found in *Horticultural Abstracts*—ED.]

504. TRINIDAD, IMPERIAL COLLEGE OF TROPICAL AGRICULTURE. 633.74
Third Annual Report on Cacao Research, 1933.
Trinidad, 1934, pp. 71, 5/-.
The main features of the report are :—Further studies on the vegetative propagation of cacao ; a preliminary survey of the pigment factors in cacao, the presence or absence of pigment having a bearing on quality of bean ; papers on the variability of budded cacao ; and on the criteria of selection in cacao ; an individual description of the trees so far selected under the Imperial College Selection Scheme ; reports of manurial experiments now in progress ; a paper on the chief characters and nutrient relationships of good cacao soils ; a study of the relationship between nutrient supply and the chemical composition of the cacao tree ; a critical examination of methods of measuring atmospheric humidity and rate of evaporation in ecological studies. Each item forms the subject of a separate abstract in this issue of *H.A.*

505. Rubber Research Scheme, Ceylon. 633.912(058)
Report of the work of the rubber research board in 1933, 1934, pp. 65.

The mycologist reports on *Oidium* leaf disease. *Fomes lignosus*, sun scorch of bud grafts, the improvement of planting material (1) by bud grafting, (2) by selection and breeding, problems connected with mature areas, i.e. tapping, replanting, soil management, and finally on work at the experiment station, Nivitigalakele. This station's activities also form the material of the Agricultural Assistant's report. As an interesting appendix to the report of the London Advisory Committee will be found notes from the chemist, Mr. G. Martin, on the following :—latex, soft rubber, water absorption, sulphuric acid, paranitrophenol, hot water treatment of coagulum, deterioration of old rubber, clone rubber, duprene (a synthetic " rubber "), packing, rubber crumb.